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The Farmer's Digest

Volume 8 January, 1945 Number 8

From Poverty Grass to Alfalfa

Condensed from Soil Conservation

C. M. Harsh

Work Unit Leader, Coshocton County Soil Conservation District, Coshocton, Ohio
(Now in U. S. Navy)

IN 1934 young Frank Hothem bought a tired hill farm. The land was typical of the thousands of acres of worn, eroded Coshocton county, Ohio, uplands surrounding it. It produced 35 bushel corn, ton-to-the-acre timothy hay, and a-cow-to-five-acres pasture. By 1943 these yields had jumped to 70 bushels of corn per acre, 2 to 3 tons of alfalfa-grass hay, and pastures which would support a husky Holstein per acre in May and June.

Then, in the winter of 1943-44, Frank Hothem sold his productive 114 acres and bought another farm — the poorest farm in the township, according to many of his neighbors. That takes guts, ambition, a plan — and faith. Frank Hothem has all four.

Let us look at his first farm to find out how he brought up the yields and battened down the soil.

Frank Hothem bought his first farm in the midst of the depression. Although he was born and raised on a hill farm of Coshocton county, Frank had worked in town for six years. His return to the land was marked by one of the worst droughts this section has ever experienced. This was not an encouraging start for a young couple married scarcely more than a year. But the Hothems were determined to make their farm pay.

In those days, when the Soil Conservation Service was still known as the Soil Erosion Service in the Department of Interior, Frank Hothem was one of the many thousands of farmers who realized that they must do something about soil erosion. He had the practical vision to know that every rain, which had been so desperately needed the year before, was now carrying away valuable topsoil and the precious

Reprinted from Soil Conservation, October, 1944, Washington, D. C.

lime and fertilizer earned by long hours of work and quarts of sweat.

On his own initiative, Frank Hothem began field stripping his cropland. They were not the efficient contour strips as we know them today, but they were a definite step in the right direction and they did save some soil. He did not stop here, however. He improved the quality of his meadows with lime and fertilizer and sweetened the mixture with alfalfa. On the pastures, Frank got busy with the mowing machine; and also put on as much lime as he could afford. Nor did he neglect the idle land, for some of the Scotch and red pine trees he planted in 1935 now stand more than 15 feet tall. In the meantime, Frank began building up a herd of Holsteins. Mrs. Hothem managed to raise a large flock of White Rock hens and care for an excellent garden. The Hothems also improved the dairy barn, installed a water system in the house and other buildings, built fences, and gradually put a new face on the entire farm.

It was slow, hard work, but there were results. The crop yields were going up slowly, the pastures were gradually responding to treatment, but Frank Hothem was not satisfied. Progress was too slow. His new plan for rebuilding this farm was good, as far as it went. He realized something was missing. Frank Hothem set out to find the answer.

His first stops were at some of his neighbors' farms. For, in the meantime, they, too, had become concerned about their soil losses, their drop in yields and their lowered income. Like Frank, a few of them were doing something about it. They were co-operating with what was popularly known as the Coshocton Research Project—a hydrological experimental station and watershed which is pioneering research of the raindrop and all of its influences. It was at these farms Frank Hothem found his answer.

He saw the excellent results of such practices as strip cropping on the contour, diversion terraces, wholesale pasture improvement, and all the other soil-saving, yield-building practices as they were installed on the advice of the technicians of the Soil Conservation Service. It was as though the tired land had received a life-giving transfusion.

When he was convinced that this new system of round farming for round country was sound, he made his decision, drew up his program.

Briefly, this is the plan he applied to his farm, made with the assistance of H. W. Black, soil conservationist, Coshocton Research Station.

On the cropland, the strips were changed from straight lines

to curved ones that followed the contour. A diversion terrace was installed to break up a long watershed. With the assistance of CCC labor, the straight fences were ripped out and contour fences constructed. A four-year rotation of corn, small grain, and two years of alfalfa-grass meadow was adopted, with the amounts of lime and fertilizer applied during the rotations doubled.

On the permanent pasture lands, Frank's program of applying lime and fertilizer was not changed, merely intensified. More than 6,000 additional trees were planted and protected. The established woodland was fenced off from livestock. Several tons of additional limestone helped Frank get his soil conservation program into operation rapidly.

None of these changes could be considered radical, for he had already operated his farm on a sound basis. But these changes, simple as they were, combined with his general all-around, good farming practices, brought results. His yields, and the value of his land, spurted.

Last winter Frank sold his farm. Ten years of hard work went with the land.

Why Frank Hothem sold his farm does not matter. Perhaps he took away a small profit in addition to the equity he had built up, but his real profit was a lot of know-how.

Frank wasn't through farming. He considered buying a high-producing, expensive river bottom farm. Finally, when the blue chips were down, he chose another hill farm.

No doubt there was plenty of eyebrow-lifting and head-shaking over the farm he selected. It had been virtually abandoned for 10 years. Briars and sumac sprouts over-ran the pastures, the crop fields were choked with hip-high weeds, the fences sagged, and the buildings needed repairs.

Frank Hothem looked beyond the weeds, the briars, and the sagging fences. The farm laid well. Predominently gently rolling slopes, only a small portion of the land was too steep for cropland, and that was protected by a thrifty stand of young timber. The buildings were located conveniently; the farm was split by a good road. Before he made up his mind Frank went a step further, a step many prospective buyers had failed to take. He dug down. He found from four to six inches of topsoil remaining. That was what he bought—160 acres of it.

His first step following the purchase of the farm was to consult County Agent G. H. Chambers. His next move was to call at the offices of the Coshocton county Soil Conservation District. Although the district was scarcely more than a year and a half old,

more than 160 farmers were already co-operating which is indicative of the progressive attitude of Frank Hothem's neighbors.

In requesting technical assistance from the district, he said, "I want a soil conservation program on my new farm based on the same identical principles as my other plan."

W. S. Donaldson, district technician, collected the aerial photographs of the farm and called on Frank. This is the farm plan they worked out together:

Fifty-four acres were selected for cropland. A 4-year, 2-unit system was planned. All of the cropland was laid out in contour strips. In one unit, the alternate strips were planned for corn the first year. In the other unit, a small grain crop was planted and seeded in new meadow. Some of the idle strips were put to use by seeding them with an emergency hay crop. Others were established in trash-mulch (site preparation by disking rather than plowing) seeding of alfalfa-grass meadows. The fertility program calls for a minimum of 3 tons of agricultural ground limestone and 600 pounds of complete fertilizer per acre for each complete rotation.

Seventy-four acres were set aside for permanent and supplemental legume pasture. A treatment program, which embodies generous and repeated applications of lime and fertilizer, and frequent use of the mowing machine, was agreed on. The ratio of summer legume pasture to permanent bluegrass was approximately one to two.

Livestock was excluded from 30 acres of young woodlands, a portion of which was improved with the addition of 1,000 seedlings.

The remainder of the farm was set aside for buildings, a garden plot, and feeding lots.

Although it was early March, this year, before the Frank Hothems moved onto their new farm, they have made excellent progress in 5 short months. They have concreted the barn and installed stanchions to make it available to the dairy herd. They have built a new chicken house. A water system has been added to the house and barn. The trash-mulch seedings of alfalfa look grand. The corn and oats hold prospects of a good harvest. The mowing machine has been busy in the pasture fields, and applications of lime and fertilizer have already been made. New fences are going up.

Frank Hothem has proved that the gap between poverty grass and alfalfa is not so wide as some think. It is generally considered a lifetime task to rebuild one farm, almost impossible to rebuild two farms profitably. Frank is exploding that theory.

We need more Frank Hothems.

Some Facts About Feeding

Condensed from The Sheepman

George W. Litton

Assistant Sheep Specialist, Virginia Extension Service

THE important thing to do with lambs is to keep them growing until permanent pasture is ready. No doubt you've seen a ewe raise her head, give a bleat (the dinner call) for two husky lambs, and have seen them come flying up the hill to their mother. As they reach her, they fall to bended knees and give a couple of lusty lunges which lift the ewe off the ground, but have the effect of starting the milk flow. Pretty soon their sides are distended with nourshing milk and they and the mother resume grazing. Milk is the basic principle in the rapid growth of lambs and the first consideration is for the proper feeding of the ewe so that she milks abundantly. It follows that whatever feeds a dairy cow can convert into milk can be used by the ewe to do the same thing. Good leafy legume hay and a balanced grain ration of 18 to 20 per cent protein content.

Other than milk the feeding of spring lambs from birth to marketing includes two distinct periods—one from birth until bluegrass pastures are ready, and the other from the time they go on pasture until marketed. The value of creep feeding lambs before permanent pasture is available has been tested by the Indiana Experiment Station and it has been found that by feeding from birth to grass, four pounds on the average could be added to the weight of the fed lambs compared to unfed lambs, and that this weight advantage was maintained clear on up until they were marketed. Here you can readily see is an advantage to be gained in pounds to sell, or—if you want it the other way—a gain of a week's time. Sometimes this time factor might be worth the most because many of us have seen the lamb market break $2 per cwt. in a week.

Many will probably "hoot" at the idea of injecting speed into making spring lambs; but the faster they gain, the better it is. We've found in tests here at VPI that lambs grading choice (which is the most desirable grade to have) average 25 days younger than lambs grading medium. They are 10 days younger than

Reprinted by permission from The Sheepman, April, 1944

the lambs grading good. It seems, therefore, that the most money is to be made by the farmer whose lambs grow and gain the fastest. This suggests that the practice of turning ewes and lambs on the poorest pasture on the roughest land on the farm is no longer a good practice in the age of "speed." Instead, it appears that the ewes and lambs rate the best pasture on the farm early in the spring, so that the lambs get in the necessary hustle to make a choice product in the fewest days.

A well-bred lamb with a heavy birth weight of around nine pounds or more, with plenty of milk from the mother, plus grain in a creep and freedom from parasites should make an average daily gain of .7 to one pound. The first load of lambs ready for market from Virginia will usually be Easter lambs from Chilhowie, a rich agriculture community in Smyth County. There are several master shepherds in this community who are really specialists at their job of making spring lambs, and the spirit of competition and rivalry which exists among them is reflected in the gains they make on their lambs. Each tries to outdo the other, with the result that many lambs will go to market weighing a pound for each day he has been on earth. Of course, these lambs never see permanent pastures.

Long before the lambs are born, the ewes are drenched with phenothiazine to insure that they are parasite-free and cannot possibly furnish a source of infestation for the lambs. As they lamb, they are put on fresh small-grain pastures and lambs are taught to eat grain in a creep long before they are a month old. They are started on real finely-ground feed, such as corn meal, to which has been added 10 per cent of a commercial fattener containing molasses. As they learn to eat, they go on to a mixture of equal parts of coarsely cracked corn, oats and bran containing a commercial supplement which will help balance their protein needs as well as appetize them to eat more. Big thrifty lambs in cool weather will eat a pound a day of this feed. In addition, they are beginning to pick at the rye and barley pasture on which they graze with their mother. Being sired by purebred rams to begin with, getting all the milk they can take, with one pound per head per day of a good grain mixture, plue fresh green pasture, is the best insurance known for accomplishing rapid growth.

Now, for the second phase of the feeding program: Usually, creep feeding lambs on permanent pasture will not pay in Virginia. The majority of Virginia lambs are marketed in July, which means that they have spent

close to three months on permanent pasture. Whether or not they are to be creep-fed will depend somewhat on the quality of pasture. From three years' experience at this station, we have figures that show fertilized pastures produce lambs that go to market earlier, sell for a higher price per head and return greater net profits than lambs from unfertilized pastures. In fact, lambs creep-fed on unfertilized pastures were not as good as lambs grazed on fertilized pastures but not creep-fed. This has led to the conclusion that a far greater return will be made on money spent for phosphate to apply to pastures than would be realized if it were spent for grain for creep-feeding lambs.

Danger in Improper Use of Fertilizers

Condensed from California Cultivator

R. E. Stephenson

COMMERCIAL fertilizers supply essential nutrients for plant growth and, when properly used, yield increases are sometimes phenomenal. Wrongly used, on the other hand, commercial fertilizers may reduce crop yields, as perhaps some have found to their sorrow.

The first effect of a fertilizer may be noticeable in the speed of germination of the seed. Any appreciable concentration of soluble fertilizer in contact with seed may retard or completely inhibit germination. The Pennsylvania station in trials with corn, soybeans, tomatoes, potatoes, cucumbers, cabbage and radishes found that the quickest germination in every case was in unfertilized soil.

Some crops are very sensitive while others, such as potatoes, will tolerate a high concentration of fertilizer although the germination is slowed down. The reason for the difference in sensitivity is not known and, though the rate of germination is reduced for all crops with seed in contact with fertilized soil, the final yield is usually greatest where rather liberal fertilization has been practiced.

How to receive all the good and

Reprinted by permission from California Cultivator Los Angeles, Cal., Oct. 28, 1944

none of the evil effects from the use of fertilizers is important. The answer lies largely in the method of using the material and, to a lesser extent, in the moisture conditions of the soil. With 30 per cent moisture the soil solution is only about half as concentrated as when the moisture drops to 15 per cent and the plants probably begin to show signs of wilting. An adequate moisture supply is necessary for the satisfactory use of fertilizer.

Much of the difficulty can be avoided by having the fertilizer placed in the soil a sufficient distance away from the seed, which is usually two inches or more. To mix large amounts of fertilizer with all the soil and plant seed immediately is a bad practice. The most effective method is to place part of the fertilizer in rills, or small furrows, two inches to the side and two inches deeper than the seed. With heavier rates of application rills of fertilizer in the bottom of the plow furrow have worked well. This places the major portion of fertilizer some six to ten inches down where the soil is always moist. A light application near the seed starts early growth quickly.

The most effective fertilizer placement leaves strips of unfertilized soil not only between the seed and fertilizer, but also strips of unfertilized soil between the rills of fertilizer. The fertilizer is also deep enough so that the soil does not dry readily. This allows the roots easy access to soluble fertilizer while at the same time affording a zone of soil where roots may function without hindrance of a high concentration of the soil solution. By this means burning, which is the name given to fertilizer injury, is avoided.

To speed seed germination, on the other hand, an abundance of rotting organic matter may be provided. Soil from under a rotting mulch produces both a higher percentage and a quicker seed germination, sometimes cutting the time nearly in half where poor soils have been mulched. The reason for this good effect of humus is not known, but the production of growth hormones by the rotting organic matter is a possible explanation. It is known that hormones are produced when organic matter rots in the soil.

All these observations sum up to a recommendation for the best use of commercial fertilizers. Heavy applications should be placed deeply, in rills or furrows, a safe distance from the seed or plant. Light applications are needed near the plant for early growth stimulation. Organic materials, particularly farm-yard manure or compost, used with the fertilizer on the same soil will increase the efficiency of the fertilizer and reduce the danger from burn. Frequent watering to pre-

vent excessive drying of the fertilized soil also will reduce the danger from burn.

Once plants are well started in the soil, growth tolerance is greater than germination tolerance for fertilizer. This is one of the reasons for the practice of side dressing plants with soluble fertilizers at frequent intervals, sometimes nearly up to the time of final harvest. A ton of sulphate of ammonia applied to an acre of soil at one time would probably cause serious crop burn. When applied in light side dressings at suitable intervals on tomatoes a phenomenal harvest resulted. A more concentrated fertilizer solution can be safely used for side dressing well established plants than may be used as a booster solution before the plants have a well developed root system.

The season of the year is also an important factor affecting the danger of fertilizer burn. In hot, dry weather only small amounts of fertilizer can be safely used at one application even when irrigation is practiced. In the early season of moist, cool weather danger of burn is relatively much less. These well established facts lead to the conclusion that skill and experience are necessary to use commercial fertilizer most effectively. When properly applied most dangers attendant upon their use can be avoided, with the prospect of a greatly increased harvest.

Balanced Farming

Condensed from Missouri Ruralist

Cordell Tindall

INDIVIDUAL farm plans which have as their goal a satisfying farm life thru good incomes, if not boosting soil fertility of the farm, is a brief description of the Balanced Farming program emphasized by the Missouri Extension service during the last few years.

In regard to wartime production the Balanced Farming program emphasized the very practices that would result in increased production.

Altogether about 3,600 Missouri farmers sat down and figured out their Balanced Farming plans and at least put them into operation. To see some of these plans in operation we went to Osage county with Albert Hagan, farm-management specialist, to visit farms using Balanced Farming. Under the leadership of County Agent Don Spalding, Osage county has been one of the foremost counties of the state in this program.

Here whole communities have figured out how to better manage their farms so they can have the comforts of a rich rural life, increase their incomes, handle more livestock, hold their hill soil in place, improve their livestock, and in general how they can do a better job of farming.

Branching off of the beautiful Maries river is Deer Creek, which forms a lovely little valley with small bottoms, sloping hillsides, and rugged ridge-tops. From any number of vantage points you can see the entire little watershed of about 1,000 acres, on parts of seven farms.

There is no more beautiful sight in Missouri than Deer Creek valley, for in addition to its scenic beauty there is the beauty of fertile fields, bountiful crops, lush pastures, fine homes and good livestock.

Virtually all the land you can see looking down the valley is protected by terracing systems, and all is farmed on the contour except the level bottom fields.

Of the seven farms, five already have Balanced Farming plans in operation and the other two are just getting their programs started.

The progress of all these farms is, of course, not entirely due to the Balanced Farming program. On the Plassmeyer farm the first terraces were built back in 1928

Reprinted by permission from the Missouri Ruralist, October 28, 1944

and from that day until now Mr. Plassmeyer has had in operation a good soil-management program.

"I wouldn't trade my hill land for good bottom land," asserts Mr. Plassmeyer, "for over a period of years I will raise just as much on my terraced hills."

Yields on this farm have been built up so that barley averages 50 bushels to the acre, corn makes from 50 to 75 bushels. Last year he threshed $50 worth of red clover seed from each acre in that soil-building crop.

The 30 head of cows, grade Shorthorns but good ones, were ankle deep in rich green barley in early October. Actually, a good portion of Deer Creek valley was carpeted with green growing crops in October, in contrast to the brown hue of most of the countryside.

Short rotations, emphasizing the use of legumes and small-grain pasture, have been worked out for these farms. Short rotations with sweet clover being turned under provide organic matter so badly needed ahead of grain crops. The short rotations not only give maximum use of the land thru double-cropping, but the more frequent sowing of small grains gets more commercial fertilizer into the ground, for most of the fertilizer used in Missouri is used on small-grain crops.

From the loft of Henry Winkelman's new barn you can look out over most of this farm. Right close to the new concrete silo is a small field of Atlas sorgo, and when the 3 acres were harvested it almost filled a 90-ton silo. This small field is in rotation with sweet clover and is heavily manured. Down the slope just a little, but still close to the barn, is another field in sweet clover now, that will go to a silage crop next year.

We mention these fields as being close to the barn because that's part of the Balanced Farming plan. By arranging to have silage crops near the silo, labor of ensiling is reduced. All of the fields of the farm are considered in a like manner. Fences often are changed to give fields of equal size, so that in a rotation equal acreages of each crop are possible each year.

Over on the slope the Winkelmans had just turned in their good herd of purebred Herefords to graze on ankle-high winter barley. Planted on the contour in a strip around the hill, a 1-wire fence was quickly thrown up on the contour to keep the cattle out of the lespedeza being saved for seed.

Last winter the Winkelmans wintered 67 head of cattle. They had about 85 tons of silage, about 60 tons of legume hay, and 12 acres of Balbo rye, plus some barley. No grain was fed.

Since putting in operation their plan of Balanced Farming, the livestock capacity of the farm has been increased about 25 per cent.

Management planned to increase the livestock capacity of a farm by lengthening the pasture season and boosting yields of grain and roughage is one of the primary aims of the Balanced Farming system. This is one tangible result.

On the farm of Albert Balkenbush, only 12 animal units could be supported a few years ago. In speaking of animal unit we mean 1 cow or the equivalent. This may mean 2 sows and a litter, 7 sheep or 1 horse or mule.

From a cash grain farm the Balkenbush acres were turned into a livestock-producing factory by young Albert. Now the farm is carrying 44 animal units, almost 4 times as much livestock.

To accomplish this the farm has a program of terrace construction well under way. Several outlets have been built to carry run-off water. Two deep ponds, fenced and equipped with tanks below, were built. Rotations to provide lots of pasture and roughage and at the same time build fertility by adding organic matter were planned.

Other enterprises received attention. An old-fashioned half-monitor-type laying house was remodeled into an open-front 20-by 20-foot house. Droppings pits make cleaning much easier. Pullets are being raised in a range shelter on clean ground, with 3 small fields serving as a rotation for pullet pasture.

Income always is a prime goal in a Balanced Farming plan. Arrangement of rotations, soil conservation practices, livestock management, all are aimed at returning profits that will provide a good living from the farm unit. Sometimes changes must be made.

Take the farm of Ernest Stieffermann, for example. Here is a small farm, typical of many small farms in South Missouri. The total area of land suitable for cultivation is only about 40 acres. Mr. Stieffermann has been handling a small herd of beef cattle, plus a good poultry enterprise. On such a small acreage it is impossible to keep a very large herd of beef cows, therefore income from this source is limited. A shift to dairying is being planned, and the farm is being put into condition to handle a small herd of cows, say 12 to 15. Returns will be higher for the same acreage.

The small fields are being arranged to handle rotations that will give maximum pasture and roughage for the dairy cows in the future. On 2 fields of 8 acres each a rotation of corn, wheat and sweet clover will put organic matter into the soil. The corn

may later be utilized as silage when the dairy herd materializes. On 2 other fields, one of 8 and one of 7acres, a barley and sweet clover rotation of 2 years will give much needed pasture. On another 8-acre field a small-grain-lespedeza rotation will fill in the pasture season and this field can be fitted into one of the 2-year rotation schemes later. Then there is a small 5-acre field of rye and lespedeza on rougher ground, and a 5¼-acre field of alfalfa for hay. These rotations are designed to give maximum feed and pasture from a small acreage.

A complete system of water management is being put into operation, too. On the far side of the farm a new waterway has just been completed and seeded down. The hillside farm will be terraced with an arrangement that will carry the water to the outlet at the back side of the farm, and Mr. Stieffermann will never need to cross either the terraces or outlet in farming operations. Another system of terraces, starting at the barnlot, will carry water to the supper side of the farm to another outlet.

The program on this farm already is showing results. Corn yields have jumped from 15 bushels an acre to 50. Wheat has gone from 7 bushels to 20, and barley is averaging 38 bushels.

Thruout Osage county are examples like this of the results of good management. In the various communities that have taken up this work are young men who are serving as leaders, often doing the difficult work of laying off contour lines and staking off terraces. Good practices spread from farm to farm as the results are observed by neighbors.

The Soil Improvement Association incorporated itself so that it could borrow money, and its 500 members offered a good market for 3 to 5 contractors, who have produced about 100,000 tons of limestone in the last few years. The association owns 12 spreaders which are lent free of charge to members.

The association also owns 6 terracing blades for which a fee of $1 a day is charged to members. In addition they have one contract terracing outfit of a crawler-type tractor, a whirlwind terracer, a bug, a blade and a level. A charge of 1½ cents a foot is made for terracing. There are 9 farm levels owned by the association, 7 in the hands of community leaders and 2 kept in the office.

The association recently lined up 50 farmers who wanted to build ponds. By arranging the details a pond contractor was engaged to build all these ponds, at a saving of $1 an hour for his work. In the last 2 years more than 150 good ponds have been built. The Missouri Conserva-

tion Commission at first supplied pipe, but the demand finally was too great. Now the soil association buys pipe, stores it in a handy place, and sells it at cost.

These are things that can be accomplished by independent groups of farmers, with no Government supervision.

The results in good soil management, in Balanced Farming, observed in Osage county, a county not especially blessed with fertile soil, should be an inspiration to all other counties of the state.

Pasture Fertilizer

Designed to place fertilizer and fine lime below but near the feeding roots of grass, a machine has successfully passed experimental mechanical tests at the University of Missouri, where it was developed. Subsurface cultivator goosenecks with sweeps were placed on angle-iron framework, upon which was mounted the distributing mechanism of a one-horse grain and fertilizer drill. Two sweeps were used as shown, but a third will be added to make the distance between sweeps 18 inches. A rolling coulter and standing knife cut the sod at present, but the rolling coulter has been found unnecessary. Sod is slightly lifted by the subsurface tillers and is rolled back into place without leaving any exposed soil in which weeds might become established.

—*Successful Farming*

Shall I Inbreed?

Condensed from the Herd Builder

Leland W. Lamb

ONE of the questions most frequently asked by dairy cattle breeders is, "Shall I Inbreed?" The subject is on the minds of farmers and fanciers alike.

To attempt to answer such a question is to invite the wrath of either the proponents or the opponents of inbreeding. Such is the violent nature of the beliefs held by both groups.

What Is Inbreeding? Inbreeding is defined as, "the mating of related animals." Note that the definition says nothing about the degree of relationship of the animals so mated. As long as they are related, their mating is inbreeding. Offspring so produced are therefore inbred animals.

Types of Inbreeding. In recent years one has been able to read little in the dairy and farm journals concerning inbreeding, so labeled. At the same time, however, these periodicals have been full of articles, and particularly of advertisements, extolling the virtues of "linebreeding." It is almost as though the two words had different definitions. Authorities in the science of genetics, however, seem agreed that linebreeding is inbreeding, and vice versa.

Inbreeding is a very unpopular word. Apparently this is because of the opprobrium attached to the practice in the minds of our predecessors in the field of practical animal breeding. As a consequence, it seems that the term linebreeding has been invented to circumvent this opprobrium attached to the old word which meant the same thing.

In the minds of many people, therefore, inbreeding and linebreeding are two separate and distinct methods of mating animals. The popular conception of inbreeding is: Any mating that produces offspring carrying fifty per cent or more of the blood of any one animal. Thus the mating of sire to daughter; son to dam; half brother to half sister; full brother to full sister, etc., are, in the minds of most people, types of inbreeding.

The mating of less closely related animals is generally spoken of as linebreeding. The mating of son and granddaughter or of grandson and daughter of the same animal are conventional types of linebreeding. Such mat-

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ings are frequently made in the hope of "concentrating the blood" of some esteemed cow or bull. It is hoped thus to duplicate, in the resulting offspring, the merits of the outstanding animal whose descendants are mated together. Surely such naivete must be conceived in ignorance of the intricacies of bovine genetics, with its countless chances for variation involved in so complicated a mechanism as nature has provided in the chromosomes and genes of the bovine reproductive system

It is perfectly true that the chances of duplicating an esteemed individual are theoretically greater when two of its close descendants are mated together than if these descendants are mated to unrelated animals. Actually, however, it appears that in most cases the esteemed individual which it is hoped to duplicate was, itself produced either by mating completely unrelated or at best very remotely related animals!

The pages of experience of many breeders of all kinds of animals which must compete with their fellow members in herds or flocks are full of the disasters resulting from the mating together of the offspring and more remote descendants of famous individuals.

A currently well known herd was "made" by one bull. For the sake of anonymity we will call him "A." This bull seemed to be generously endowed with that mysterious quality often spoken of as transmitting ability. He, himself, a mediocre individual as judged by show ring standards, and not from an exceptional cow, was loaned to the institution that used him to breed a group of cows assembled from all over the state for experimental purposes. Yet this bull made a nationally known herd. His daughters were magnificent, big heavy producing cows. To recount their records and showing accomplishments would require more space than we have. Yet his use on these assembled cows was not in any sense a linebreeding proposition.

It was decided that the best way to preserve the "blood" of the great bull was to linebreed his descendants. Two of "A's" most famous daughters were "Bonnie" and "Bess." Bonnie was bred to a carefully chosen bull and produced a son which we will call "Prince." Bonnie was next bred to another carefully chosen bull and produced a nationally famous daughter Bonnie 2d. At about this same time Bess was bred to Bonnie's son, Prince, producing a bull calf, Buster. (This was a linebred calf being by a grandson and out of a daughter of "A"). Bonnie's son, Prince, was mated to her daughter, Bonnie 2d, producing an inbred daughter, Bub-

ble. Bubble was a double-granddaughter of Bonnie. Later, Bubble was bred to Bess's son, Buster, producing a heifer calf, Fizzle. Thus was produced four generations of females.

(1) Bonnie, finally destroyed at 14 years, after doing everything a cow can possibly do to win a place in the hall of fame. She made several high records, produced good sons and daughters, was named all American and demonstrated correct type to countless students and farmers. Yet she was an outcross cow. Her sire and dam were completely unrelated as shown by a three generation pedigree. The fact of no common ancestry in the first three generations should rule out the possibility of Bonnie's excellence being attributable to linebreeding.

(2) Bonnie 2d, daughter of Bonnie, started her career by being named All American as a Junior yearling. Milked four times daily she produced over 800 pounds fat in 365 days as a Junior two-year-old. As a four-year-old she produced over 1000 pounds fat on three times daily milking in 305 days, was sold at auction for a fabulous price and has since produced over 900 pounds fat on twice daily milking in 365 days. Her sire and dam were very, very distantly related.

(3) Bubble, double granddaughter of Bonnie, was, as is so often the case with inbred cows, "a hard luck cow." She was nursed along through one test, making only 470 pounds fat on three times daily milking in 365 days at two years, two months. She suffered an almost endless series of misfortunes during that lactation and was not put on "test" again. Finally, at about four or five years of age she was mercifully destroyed. Thus ended the suffering of the inbred double granddaughter of the super cow Bonnie.

(4) Fizzle, double granddaughter of Prince, triple great granddaughter of Bonnie and quadruple great, great granddaughter of the old herd builder, A, never even came in heat. She made fair hamburger.

Thus we have the story of the four generations, starting with the brilliant Bonnie, carried on by the almost equally brilliant Bonnie 2d, starting to fade with the baffling Bubble, and ending tragically with the pathetic Fizzle.

No criticism of Bonnie is expressed or implied. She was a great cow. So is her outcross daughter. So, likewise, have at least three of her outcross sons proved to be so far. At least one of her inbred daughters died as a young heifer. At least one of her inbred sons has always been a delicate, special-handling case without much vigor or vitality.

He was sired by her own grandson.

The case of Bonnie, and her linebred and inbred descendants is merely used to illustrate what so often happens when a breeder embarks upon a linebreeding or inbreeding program—call it what one may.

Who Started the Linebreeding Idea? Responsibility for starting the idea of inbreeding seems to be veiled in obscurity. The Collings and the Bakewells used it. Judged by standards in vogue at that time they were successful. But their cows were not expected to produce milk and butter fat year after year at a high rate.

Breeders on the Islands of Jersey and Guernsey practiced inbreeding. Their cows were tethered in lush meadows, fed roots and other appetite-stimulating feeds. Their breeding efforts were accompanied by a high rate of mortality among their calves, unless extreme measures were taken to protect them from extremes of temperature. Further, in most cases the results of their breeding operations were not judged by high year after year production of their cows. Since about 1870 their cattle have been bred "to look pretty" and hence to appeal to exporters with a rich American clientele.

Who Has Continued the Linebreeding Fallacy? American fanciers, business men with farms for hobbies have continued to recommend and to practice linebreeding. It should be remembered that their cows have not generally been expected to earn their way. Further, the producing ability of their cows is not usually judged by year-after-year production. Rather such breeders are generally content with one test on each of a few selected cows, given every possible advantage as to feeds, care and general environment. Many a delicate, inbred cow, provided the inheritance is present, can make a creditable production record under such conditions. Put the same cow under practical farm conditions and she will either die or look as if someone should put her out of her misery.

In recent years farmer breeders have started emulating their wealthier neighbors. Yet their cows have to earn them a living.

Such inbred animals often do not show their true colors until they begin to try to milk. After they freshen, however, a real dairy husbandman will notice that they do not eat well. Consequently, they do not milk well. They are the "hard luck" cows.

Poor producer, though such an inbred cow may be, she may still be a valuable breeding animal, if she breeds at all, provided she is mated to a high transmitting, unrelated bull. The resulting daughter may be expected to

grow into a high producing cow with all the vigor and vitality one may expect in any cow.

Many of our best breeders are successfully using inbred bulls on unrelated cows today. Often they lack the looks, the vigor, and the vitality of their outcross brothers. But, if they are inbred from high transmitting ancestry they may be expected to transmit the factors for high production to their daughters just as any other bull might do.

Take the case of Royal Colantha Wayne V. Eleven mate-daughter comparisons give him an index of 16,984 pounds milk, 3.78%, 642 pounds butter fat. He is an inbred bull used on unrelated cows. His daughters are excellent prdoucers. Yet his own full sister (inbred, too, of course) has three records which average only 9,001 pounds of milk, 4.3% and 390 pounds butter fat.

If we are to judge the potentialities of a young bull by the performance of his older full sisters, a logical basis for so judging a young bull, we should know whether or not the animal in question is inbred.

It appears that, from a milk and butter fat production standpoint the debilitating effects of inbreeding vary with its intensity. Thus sire-to-daughter or dam-to-son breeding generally begets poor producers. Less intensive types of inbreeding do not show up disastrously so quickly. Sooner, or later, however, when judged by cows' year-after-year production, inbreeding, be it intense or mild, results in decreased vigor, lessened ability to withstand the rigors of high production, and finally in complete disintegration, or "going to pieces." It may be shown in one or several of many ways—e.g., poor appetite, resulting in low production; small size; poor type; dopey disposition; susceptibility to colds and pneumonia; udders breaking down; low fertility, etc. A fair statement seems to be, the more closely the animal is bred the more likely is she to be an unsatisfactory member of a working dairy herd.

Inbreeding Does Not Pay. The man who expects his cows to earn his living will usually find that inbreeding does not pay because:

(1) It usually results in lowered production in the inbred daughters when measured by their production over a series of consecutive years.

(2) It usually results in shorter lived cows—thus increasing the rate of turnover and the need for raising a larger number of heifers in order to maintain a certain size herd.

(3) It produces more delicate calves—thus increasing calf losses and adding to the expense of raising those that are kept alive.

Breed and Grow Your Own Dairy Herd Replacements

Condensed from Kentucky Farmers Home Journal

Lynn Copeland
University of Kentucky

EVERY dairyman has the problem of maintaining and improving his herd. The individual farmer with a herd of ten cows must raise at least two heifer calves each year and to safeguard against disease and accidental loss should save at least three heifer calves annually as future herd replacements.

The success of every dairy farmer depends in no small measure on the careful rearing of the future herd. The good dairyman sees in each heifer calf a future cow that will not only eventually replace a discarded member of his herd, but also a cow that he hopes will improve his herd. One of the most common mistakes is the failure to raise replacements and the continued purchase of heifers and cows to maintain the herd. Another equally important mistake is the failure to properly grow out and develop the heifer calves retained as future herd members.

There is a tendency on the part of many farmers to try to economize on the feeding of the young stock. The results are small, undersized animals that never develop into satisfactory producers. The desired size of the various dairy breeds according to the various breed score cards is as follows:

Jersey	1,000 lbs.
Guernsey	1,100 lbs.
Ayrshire	1,150 lbs.
Brown Swiss	1,400 lbs.
Holstein	1,500 lbs.

It is known that two factors affect the size of a mature animal. The first is inheritance and the second is development. Most of the cattle of the dairy breeds possess the inheritance to grow into animals approximating the breed standards of size if they are given the opportunity of doing so. The secret of developing dairy heifers into cows of satisfactory size is to keep them growing continually. The urge to grow is stronger at six months than at a year and it is stronger at a year than at two years. Animals once stunted rarely ever develop into good size at maturity. In this con-

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nection, the West Virginia Experiment Station has recently assembled a large amount of growth data on dairy heifers. These data have been collected at many of the agricultural colleges and the U. S. Department of Agriculture. The results show that most of the skeletal growth is completed by the time a heifer is two years old. Very little increase in height is made after two and one-half or three years of age. Consequently if a calf is starved and stunted and is undersized as a two-year-old we cannot expect her to grow up to be a big cow. At best she can be only a good little cow. When selecting dairy heifers the height should always be considered. Body weight may vary some but unless the animal has been stunted the height should closely approximate the normal for the breed.

Numerous data have been published showing that within the breed larger cows are more profitable. Feed is too scarce to waste on poor producers. The best way to improve dairy herds is to breed the replacements and then grow them out into good sized strong, rugged cows. This cannot be done by roughing the heifers through the winter. Keep them growing. It will pay many times over when they come into milk.

Lighter Grazing, More Beef

Heavy stocking of ranges just doesn't pay. This is brought out conclusively in grazing studies on the 12,800-acre Central Plains experimental range in northeastern Colorado. Under conservative grazing from May 10 to November 10, long-yearling Herefords made average gains of 325 pounds, while under heavy stocking for the same period similar cattle made gains of only 190 to 250 pounds. As a rule the latter groups lost weight in late September and October.

Based on these tests the following recommendation is made for average years: 2½ acres per cow for short-grass range in excellent condition; 3¾ acres where the land is in good condition; 5¾ acres where fair, and 10 acres where poor.

—*Farm Journal*

More Pork at Less Cost

Condensed from The Farmer

WHATEVER the demand for pork and lard now or when farmers go back to peacetime production, the man who makes the most money in the commercial hog business is the one who gets the most pounds of pork per litter at marketing time, and who gets the fastest, cheapest gains between farrowing and marketing.

These fastest, cheapest gains and most pounds per litter may come from droves of one of the old, long established breeds, but more than 4,000 pigs farrowed this year, and observed by Dr. Laurence M. Winters of the College of Agriculture, University of Minnesota, indicate they won't. The guess, based on the performance of these new pigs—Minnesota No. 1's, and Minnesota inbreds—is that hybridization of hogs like hybridization of corn results in lower costs and higher yields.

Dr. Winters and associates started their experimental work in 1936 in an effort to learn what, if any, gain would result from hybridization of hogs. They began two procedures in breeding at that time. One was the close inbreeding of two families within a breed (they used Poland Chinas) and then crossing these inbred families. The other was close inbreeding of families within two breeds, and then crossing the breeds.

Results proved that increased vigor measured in terms of number of pigs per litter, survival, rate of gain and economy of gain followed the crossing of inbred lines, and that the degree of increased vigor paralleled the degree of inbreeding. In addition it was found that crossing of an inbred line of one breed with an inbred line of another gave a greater increase than line crosses within the Poland China breed.

The new breed of hog, Minnesota No. 1, is a cross between inbred Tamworths and inbred Landrace. The Landrace side of the new breed's ancestry is a pig that originated in Denmark. It is a long, deep animal with excellent hams, it is outstanding for fertility, and in the cross has transmitted these characteristics to the offspring. The Tamworth, long familiar to American hogmen, is an English bacon type, and its chief contribution to the offspring has been high milk production to keep litters growing. Its red color also is the color of the No. 1, although the No. 1 has

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black flecking which the Tamworth doesn't have.

The length of body of the No. 1 to the casual observer creates an optical illusion. It makes the animal appear extremely wasty in neck and head, but actually the reverse is true as proved repeatedly when carcasses are cut up.

At the Grand Rapids (Minn.) Experiment Station where the development work has been done and where it is being continued, litter averages have been 9 to 10 pigs and average weight per pig at 112 days of age has been 110 pounds. To produce 100 pounds of gain has required 300 to 310 pounds of feed, an almost phenomenal performance. These figures cover 20 to 25 litters a year or a total of about 1,500 pigs during the last several years.

Minnesota No. 1 boars and gilts have been sold to farmers throughout Minnesota, and to some in North and South Dakota. George Little, Winona, Minn., is one of the breeders who has had excellent results with No. 1's (No. 1 gilts to No. 1 boars) he has also bred some Hampshire, Poland China, and Chester White sows to No. 1 boars. Although the Hampshire cross has the Hampshire color, and some of the other Hampshire characteristics, it is stamped by the No. 1 length of body. Similarly the progeny of the other crosses have more their sire's conformation than that of their dam's.

Mr. Little recalled his own observations of the pigs as the first of them were developing in his feedlot:

"When the first of the No. 1's were about two and a half months past weaning age, I was disappointed. They appeared to weigh only about 80 pounds but when I weighed three or four of them I found that I had been fooled. Those pigs actually weighed up to 110 and 120 pounds.

The No. 1 boar which Mr. Little now has in his herd weighed 50 pounds at 56 days of age, and at 140 days he weighed 202 pounds. His rate of gain from weaning to 180 days was 1.88 pounds a day, and the feed requirement for the entire litter was 276 pounds to produce 100 pounds of gain.

Use of the closely inbred Poland China boars on either purebred sows of other breeds or on crossbred sows also has proved highly satisfactory. On the William Benitt farm near Hastings, Minn., these boars have made an excellent record. Average feed consumed per 100 pounds of gain totaled 395 pounds, 340 of which was corn, 18 of small grain, 9 of concentrate under 25% protein, and 28 of concentrate over 25% protein.

For purposes of comparison the Benitt figures were lined up

against the averages secured from 114 Southeastern Minnesota farms where records are kept in co-operation with University Farm's record keeping service. The operators of these farms fed an average of 470 pounds of the kind of feed Benitt fed and in addition fed 229 pounds of skimmilk to get 100 pounds of gain. Put on the basis of feed cost per 100 pounds of gain, Benitt's was $4.40, while the average on the 114 farms was $6.50, a difference of $2.10 in favor of the pigs in the Benitt feedlot. Moreover, the number of pigs weaned per litter in Benitt's drove averaged 7.5 while the average for the 114 farms was 6.4.

The performance of the inbreds and the new Minnesota No. 1's gives rise to questions about their utilization. The Minnesota No. 1's characteristics are well enough fixed in them as a breed that their offspring may now go forth to establish new droves. But how to supply farmers with the inbred boars to be crossed with purebred, grades, or crosses of other breeds is a question difficult to answer. Certainly the Experiment Station could not fill the demand if popularity of the inbreds became widespread. Is there a prospect that breeders themselves may inbreed their own lines long enough, and be skillful enough in their selection of foundation stock that they could fill the demand? The evolution of the hog business might take that course, but if it does breeders will have to be compensated for their work and skill, and prices of inbred boars might therefore be higher than the run of producers would pay.

It is possible that some large producers might do their own inbreeding and crossing, then sell hybrid weanling pigs to hog feeders who formerly raised their own pigs. Such weanlings could, by reason of their thriftiness, their ability to put on gain at low feed cost, and their other desirable characteristics command a higher price than ordinary feeder pigs. Such a development parallels the hybrid seed corn business.

Dr. Winters and his associates ponder such questions as these, but they make no pretense at having the answers. They do maintain, and with proof, that skillful hybridization of hogs does result in more pigs per litter, more pigs marketed per litter, and faster and cheaper gains.

Coarse Roughage for Cattle

Condensed from Pacific Rural Press

H. H. Cole
University Farm

MORRISON in his book, "Feeds and Feeding," describes the chief essentials in the proper feeding of dairy cattle as follows:

"1. The use throughout the year of economical, well-balanced rations, which provide the nutrition essentials. . . ."

"2. Adjusting the amount of concentrates for each cow to her actual production."

"3. Palatable rations, containing a reasonable variety of feeds."

"4. Some succulent feed in the ration, except when succulent feeds are unduly expensive."

"5. Rations that are slightly laxative, instead of constipating."

From a nutritional standpoint these are excellent suggestions, but recent studies have shown that it is possible to meet all these requirements and still have a very unsatisfactory ration. One could pasture on succulent alfalfa, for example, and supplement the pasture with a concentrate mix to provide all of the essential nutrients. If the alfalfa were sufficiently succulent and the field were devoid of plants other than alfalfa such a diet would be fatal, particularly if lactating dairy cows were used. What is wrong with such a diet—it is economical at least for most irrigated sections, it is well-balanced, assuming that several grains would be used in the concentrate mix, it is fairly palatable, succulent and laxative, and it is known, furthermore, that cattle will thrive on alfalfa hay without supplements other than minerals?

Such a ration lacks coarse scratchy material and the following symptoms will develop:

(1) Rumination will be absent.

(2) Appetite will be less than if a coarse scratchy feed were added.

(3) Most of the animals will bloat and some will die unless precautionary measures are used.

(4) Those that survive will show evidence of craving as manifested by wood chewing or eating of dirt.

How do we know that these symptoms are due to a lack of scratchy materials? This has been very simply demonstrated by comparing a ration of whole

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alfalfa hay with a ration of finely ground alfalfa each being supplemented with concentrates. The above enumerated symptoms appeared when finely ground alfalfa was fed while the cows on whole alfalfa appeared entirely normal. The only difference between the two rations was the grinding of the alfalfa, making it less coarse and scratchy.

All this adds up to the fact that coarse roughage is essential for the proper functioning of the digestive tract of cattle. Given half a chance, a cow will see to it that she obtains roughage of this sort. Most grasses have rough leaves and this no doubt explains the preference which cattle may show for grasses over the smooth silky succulent legumes. Have you ever observed cows eating dry, and what appears to be unpalatable, weeds around the edge of a lush alfalfa field, or have you seen them eat straw when the rack was full of fine leafy hay? An expression of their desire for coarser feeds?

Numerous experiments have shown that bulk alone is not sufficient. If bulk is added to a ration in the form of soft paper pulp or cellophane, symptoms of deficiency still appear, although the necessary nutrients have presumably been supplied. In rare instances very leafy fine-stemmed alfalfa hay may not be sufficiently coarse to prevent bloat if fed to cattle on full feed.

I do not wish to infer that the feed rack for cattle should be kept filled with weeds and straw. Rarely is trouble encountered with good quality legume hay unless it is cut prematurely or if it is a new seeding and is, therefore, very fine-stemmed. Furthermore, the use of legume pasture should be encouraged rather than discouraged. However, unless stands of alfalfa contain grasses or other foreign materials they should not be pastured before the early bloom stage without supplemental feeding of hay. We have found that the feeding of Sudan hay is an effective means of preventing bloat on such pastures. The milking cows were given free access to the hay each night before being turned to pasture the following day. For dry stock continuously pastured, bloat was prevented with about 10 lbs. per cow a day fed in pasture.

Reducing Apple Drop with Harvest Sprays

Condensed from American Fruit Grower

M. B. Hoffman
Cornell University

THE harvest sprays which have been found effective in delaying the drop of apples and pears should prove to be of considerable help in many cases. This treatment is not a complete solution to the drop problem during an extended harvest period and there are certain precautions that should be taken in connection with it. Nevertheless, when the limitations of the practice have been fully realized and it has been properly used, the results have been very gratifying.

Apples, as they approach maturity, will continue to form red color and increase in size as long as they hang on the tree. It is recognized, however, that there is a definite stage of maturity at which each variety should be picked if the fruit is to develop its best keeping and eating quality. If we could by some means delay dropping indefinitely, we would still have to harvest the various varieties each year at approximately the same time (depending on the season) in order to prevent over-maturity and early deterioration from taking place.

The process of abscission or dropping of fruit is associated with maturity. The ease with which the apple stem separates from the spur is one of the ways to recognize approaching maturity. The abscission zone is just as strong as any other part of the stem until certain processes accompanying maturity begin to operate. When these processes set in, the walls of the cells of the abscission zone are weakened or dissolved out and a crack or split takes place across the base of the stem which cuts the apple off. The rate of respiration and all the ripening processes are increased by an increase in temperature, consequently hot weather results in a greater apple drop than does cool weather. There are other conditions such as a high nitrogen level of the trees or a low carbohydrate supply resulting from inefficient foliage that contribute to the total amount of drop but when all factors are considered, warm weather during this critical period seems to be the most potent.

In any orchard and for that matter on any given tree, certain

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apples begin to mature, and as a consequence, abscise or drop before others. There soon comes a time when a large proportion of the crop will reach this condition and if the harvest is not quickly completed, the loss from drop may be heavy. This can happen before satisfactory red color develops, especially if hot weather prevails. High temperatures seem to delay the formation of red color and at the same time hasten these other processes associated with maturity. The harvest of a good crop may start before any appreciable drop has taken place only to have dropping increase from day to day. Under such conditions, a moderate wind or the slight jarring of limbs incident to picking operations will result in a large loss of fancy fruit.

The chemical used in the harvest sprays seems to temporarily counteract in some way the process of abscission or some other process responsible for abscission. In this way it delays drop of the fruit. The treatment does not seem to influence the rate of ripening, color formation or increase in size. So long as the apples do not drop, these processes go on at a normal rate which is affected by weather and nutritional conditions. The value of the harvest spray, then, would seem to consist mainly in a protection from excessive drop during the normal harvest of a well-matured crop.

Generally one to three days are required for these sprays to become effective. The maximum effect is usually reached in about five days. The length of the period of effectiveness varies with the variety and also depends to some extent on weather conditions. The effects of a single treatment may persist for two to three weeks with most varieties. In the case of the McIntosh, however, this period will not be longer than seven to ten days when it seems to end rather abruptly, resulting in the immediate start of drop. McIntosh shows a temporary but very pronounced increase in the rate of respiration as it reaches picking maturity. This may explain why the variety is characteristically a heavy dropper and why the harvest spray has a shorter period of effectiveness on McIntosh than is the case with most other varieties. With any variety the period of effective drop control seems to be shorter during warm weather than it is during cool weather. This may also be associated with respiratory activity.

Because of the short period of effectiveness on McIntosh the application should be delayed until some evidence of drop is noted so as to obtain the maximum protection at the time when drop is heaviest. The treatment

should precede the harvest of any given group of trees by an interval of not more than eight or nine days. This may mean delaying the application on some trees until the harvest of others is under way. A duplicate application on McIntosh, made four or five days after the initial treatment, has extended the period of drop control for several days beyond that secured with a single spray. Since there is a longer period of effectiveness on other varieties, the application can be more conveniently made prior to the beginning of picking operations. If considerable drop has taken place before the spray is applied, indicating that the abscission of many fruits is well under way, the results are likely to be disappointing. Correct timing of the application is probably the most important single factor in the successful use of the harvest spray. Thorough spraying so as to cover all leaves and reach the fruit stems is also essential.

The harvest spray is most effective when applied during the warmest part of the day because it probably enters the tissues more readily under such conditions. A concentration of ten parts per million of the chemical has come to be regarded as sort of a standard recommendation. This is the strength usually suggested on the labels of the various proprietary products. It can be regarded as a general or basic concentration from which variations can be made depending on the variety, vigor of the trees, condition of foliage, and temperature. For varieties on which the treatment has proved particularly effective, such as Delicious, it is likely that five parts per million, or one-half the usually suggested concentration would prove sufficient if the trees were vigorous and the temperature at the time of application was 75°F. or higher. This concentration could be increased if cooler weather prevailed. McIntosh and other varieties that offer a similar drop problem should receive a spray containing ten parts per million.

During the past three seasons, a talc dust containing 0.1 per cent napthalene acetic acid has given equally satisfactory results in drop control on McIntosh as has the same material applied in spray form at concentrations of ten parts per million. The trees used in those tests were of a young age (17 to 20 years) and were quite vigorous. Whether or not dusting as a means of applying these chemicals will prove to be as effective as a liquid spray with all varieties and under all conditions remains to be determined. The material in dust form is more expensive but it can be applied very rapidly with a considerable saving in time and labor.

New Pasture from Rocks

Condensed from Farm Journal and Farmer's Wife

EVEN in 1944 the pioneering spirit is still alive in some of the oldest farming areas of the United States. Case in point is the dairymen brothers, Bob and Arthur Sawyer, who operate a farm in Rockingham County, New Hampshire. The Sawyer purebred Ayrshires produce well for them, they have a good retail outlet for the milk, and a large investment in barns and buildings.

Recently, when taking inventory, they discovered that their business had outgrown the capacity of the farm. No. 1 need was more pasture. Where could they get it? The only nearby land available was a twenty-acre pine woodlot which had been cleared three years before, but was still covered with rocks and boulders of all sizes.

In the past, the Sawyers had spent some time during slack seasons draining marshy places in their fields by digging ditches and putting in stones instead of tile for drainage. However, they had never tried this on a large scale with power equipment. Now they really needed the land and needed it soon — something had to be done.

So, with a power shovel, the Sawyers dug several ditches 12 feet across and 5 feet deep in low places in the potential pasture. In the low ditches they placed the rocks, large boulders in the bottom and smaller stones on top, until the ditches were nearly full, The dirt was shoveled back over the rocks to a depth of about two feet, and the land was ready to be plowed.

The result is that the Sawyers not only have twenty acres more pasture, but, should they change their plans, they have twenty acres of crop land, with all rocks buried well below plow depth.

H. C. Woodworth of the Agricultural Experiment Station at the University of New Hampshire has followed the Sawyers in their project, and believes it may well suggest post-war moves for other farmers in rocky areas.

Woodworth doesn't believe that every farmer should go out immediately and clear all of his land of rocks. In many cases, however, where the investment is large, small-farm operators may find it necessary to make more land available for tractor operation, if they are to compete with larger farmers. After the war, it may be possible for groups to cooperate in buying surplus war

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equipment to be used in clearing.

The Sawyers put more than a thousand dollars and their labor into clearing their twenty acres. In many cases this would be more than a farmer would be justified in paying. In their case, however, with their special market and large investment in cattle and equipment, they are certain the additional pasture will more than pay for the cost of the improvement.

Penicillin Production and Agriculture

Condensed from The Agricultural Situation

O. E. May

Bureau of Agricultural and Industrial Chemistry, ARA

PENICILLIN is the name of the remarkable new drug so successful in the treatment of wounds and infectious diseases common to the war. It has already saved the lives of thousands of men and will save the lives of thousands more before the war is over. It has been called the outstanding medical development of this war and considered so valuable to the armed forces that until recently virtually all production has been requisitioned for military use. It is as important in its field as the sulfa drugs are in theirs, and the number of lives saved since their discovery a few years ago is well known.

The remarkable properties of penicillin are due to its ability to kill bacteria. In certain infections it kills the causative organisms, or stops their growth entirely, without harmful effect on the patient. It is not, however, a cure-all, since it is not effective against all types of infection.

Among the diseases known to be routed by penicillin are osteomyelitis, pneumonia, gas gangrene, and gonorrhea. It cures certain types of infection against which the sulfa drugs fail. Penicillin is being used with great success in the treatment of infected wounds. One of the most dramatic effects of the drug is the almost immediate relief from pain that it affords.

Penicillin is administered externally, in the case of wounds or surface infections, or by injection, but is ineffective when taken by mouth. The amount re-

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quired for a cure ranges from 100,000 to 150,000 units for gonorrhea to a million units or more for most other infections.

Although comparatively new, penicillin came into the limelight so fast most people already have heard about it. But the general public is not aware that the production of this new drug is linked up with agriculture. Penicillin is produced by a mold that lives on a diet composed almost completely of agricultural products and gets its name from that mold: "penicillium notatum." This particular mold is just an ordinary green-colored microorganism resembling the mold sometimes seen on bread, cheese, and other household products. The mold grows easily but does not yield worthwhile quantities of penicillin unless maintained under ideal conditions and fed on the proper diet. Producing penicillin is certainly not a household task. It's a laboratory job that must be done by trained scientists under carefully controlled conditions.

The observations which led to the discovery of penicillin were made in 1929 by Alexander Fleming, a British scientist. Ten years later H. W. Florey, of Oxford University, produced enough penicillin to determine clinically that it was one of the greatest microbe destroyers ever encountered, but the yield of the drug was so low that its production on a commercial scale was simply out of the question. The great need for this drug in the war caused British scientists to bring the penicillin problem to the United States during the summer of 1941 in the hope that our method of doing things on a big scale might be applied to the production of penicillin. And it was.

Soon after their arrival in America, the British scientists were sent to the Bureau of Agricultural and Industrial Chemistry's Laboratory at Peoria, Ill., which has one of the largest collections of industrially important micro-organisms in the world and a research group with years of experience in the field of industrial mold fermentations. The upshot was that important discoveries were made from the research program set up to study the penicillin production problem.

Scientists in the Peoria Laboratory set out first to increase the yield of penicillin in the hope of getting commercial production started as soon as possible. The mold was fed on a new diet made from the steeping liquor obtained in the production of corn starch by the wet-milling process. There are large quantities of this liquor commercially available at a low price. Some of it is used in making yeast, but because there is little or no other use for it, most

of it goes into cattle feed. The scientists found also that the mold preferred, in addition to the corn steep liquor, some lactose, the sugar present in cow's milk —another agricultural product. This new diet, and improved growing conditions, plus the use of better strains of molds increased the yield of penicillin more than 100 times and in a comparatively short time. This made it possible for industry to take over and start production on a commercial scale.

There are two main methods used in the production of penicillin — the surface method and the deep-tank method. In the surface method the mold is grown in shallow pans or even two-quart size milk bottles, stacked side by side and on top of each other. In this method the mold simply floats on top of the solution.

In the deep-tank or submerged method the mold is grown in large tanks deep under the surface, and stirred with mechanical agitators while air is pumped in. Tanks in some of the commercial plants hold as much as 12,000 gallons. The surface method is the one used by the British scientists and the one that was used at first in the experiments at the Peoria Laboratory. The deep-tank method is the outgrowth of the deep-tank fermentation research pioneered by Department scientists for more than fifteen years. Most of the penicillin being produced today is made by the deep - tank or submerged method.

Based on the improved fermentation methods developed at the Peoria Laboratory, the commercial production of penicillin is now under way in twenty-one chemical and pharmaceutical plants in the United States and Canada. These plants have been rushed to completion and represent an investment of more than $20,000,000. Owing to its contributions and leadership in developing the fermentation processes, assay techniques, and procedures in isolating and purifying the drug, the Northern Laboratory has become a sort of clearing house for consultations and instructions in the manufacture of penicillin.

Consulting services have also been furnished to scientists of the other Allied Nations. Visits have been exchanged with English workers, and the art of making penicillin has been taught to Canadians, Australians, Chinese and Brazilians. One Australian Army officer, after spending some time at the Northern Laboratory, was producing penicillin in quantity within seven weeks after he returned to his own country. Part of this penicillin is said to have been made available to our troops in the Southwest

Pacific on a reverse Lend-Lease basis.

The penicillin production record speaks for itself. During all of 1942, production probably did not exceed 100 million Oxford units—an arbitrary standard for measuring the germ-killing powers of a penicillin preparation. Production during the first five months of 1943 amounted to slightly more than 400 million units while an equal amount was produced in the following single month of June. After that, production nearly doubled each month and climbed to 9 billion units in December of '43, 12 billion in January of '44, 19 billion in February, and 40 billion in March.

Production by the end of this year should be around 200 billion units a month, which is enough to treat about 250,000 serious cases of infection. At present the amount of penicillin available for civilian use depends on how much is required by the armed forces. They get first call. But production is increasing at a rapid rate and more penicillin is being allocated for civilian use every day . . . in fact 2,100 hospitals are now receiving it. The price has dropped from $20 per hundred thousand units to $3.25, a reduction of 84 percent in a year, and it will undoubtedly go lower as production increases.

The basic fermentation process developed at the Northern Laboratory is being used by all but two of the present commercial producers of penicillin. This process, based on the use of corn steep liquor and milk sugar, has paved the way for large-scale commercial production. There is plenty of corn steep liquor, but it has been necessary to more than double the output of milk sugar to meet the demand for this product due to its wide use in the production of penicillin.

The commercial production of penicillin represents an entirely new industry based on agricultural products that was not even in existence 2 years ago. It involves a new source of annual income of more than $50,000,000, some of which will indirectly find its way back to the farm. This monetary evaluation is in addition to the immeasurable value of the research which led to the commercial production of this remarkable drug and the part it is playing in saving human lives. It is one of agriculture's outstanding contributions to the war and a development that will live to benefit humanity long after the world is at peace.

Observations on Agriculture in Iran

Condensed from Farm and Home Science

D. W. Pittman

THE agriculture of Iran (more familiar to most of us by its former name of Persia), as I observed it in nearly three years' service with the Iranian Ministry of Agriculture, is in many respects similar to the agriculture of the southwestern desert states with a small piece of Louisiana thrown in and the whole with rather an oriental cast. Some of our major cultivated crops, such as alfalfa, probably originated in Iran.

Iran lies between Mt. Ararat, the south end of the Caspian Sea and the Turkoman dry plains of the U.S.S.R. on the north, the Persian Gulf on the south, and between the hot desert plains of the Tigris and Euphrates Valley on the west, and the mountains of Afghanistan and Baluchistan on the east. Turkey touches the northwest corner and India is adjacent to the southeast.

The country is remarkably similar to Utah and Arizona—the same steep, rugged mountains, the same high desert basin between the mountains, and the same red sandstone cliffs and hills interspersed with grey adobe saline valleys. Kouzistan, the country near the head of the Persian Gulf, between the high Zagros Mountains and the sea, is a low desert plain hotter than any place here, except perhaps Death Valley. Nearly all of this part of the country is arid with an annual precipitation of about 4 to 9 inches—nearly all in the winter—except on the high mountains where there is considerable snow. Mazanderan, a narrow strip of the country between the south end of the Caspian Sea, which is about 85 feet below sea level, and the high Elburz Mountains to the south, is hot and humid with a precipitation of approximately 56 inches per year. The deserts are clothed, if at all, with the same, or similar, sagebrush and greasewood as ours and the stony hills with the same junipers, but the mountains are lacking any extensive development of spruce or pine. The north (humid) side of the Elburz Mountains facing the Caspian has a moderate growth of beech, oak, and other deciduous broadleaf trees which are mostly used for charcoal in this land of little fuel.

There is great diversity of crops

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in Iran. Wheat and barley are the chief grain crops in all the desert sections. They are mostly raised by irrigation, though in some areas considerable dry-farming is practiced. The wheat is nearly all winter wheat and much of the barley is winter barley. Perhaps winter-hardy spring wheat and barley are more correct terms since the winters in most areas are not sufficiently severe really to stop the growth of the plant between the time of fall seeding and of early summer harvest. Under irrigation as much wheat is planted as can be adequately irrigated in June when the wheat needs its last watering and then enough barley which matures earlier is planted to make use of the more abundant early spring water which is not needed for other crops. Both for irrigated and dry land ("daim") grain, the only rotation used is one crop of grain followed by two or three years of uncultivated fallow or rest for the land. Adjacent to each village there is usually available three or four times as much good grain land as can be served by the water available and only about one-third to one-fourth of the land is used each year. Since usually all the land of each village, or several villages, belongs to one man and the villagers are simply share croppers with no permanency of tenure the problem of distribution is easily handled. In only a few areas, such as in the vicinity of Isfahan and Yazd, is the land divided into small individual holdings. It is interesting to note that the men of these districts are considered to be the best farmers in Iran.

In humid Mazanderan, rice (flooded by irrigation) is the principal crop. Rice makes up a large part of the diet of all the people of Iran, except in the poorer villages. Formerly considerable rice was also grown in Kouzistan. Its culture there was forbidden by the former Shah in order to reduce malaria in this district, but it is slowly being established again. Studies in India show that while the culture of rice will usually increase the number of malarial mosquitoes in a district, yet, because the people are better fed, the actual amount of sickness resulting from malaria may be decreased.

Caster beans, cotton, tobacco, poppies for opium, jute, sesame, broad beans, sorghum and broom corn are some of the more extensively grown field crops in the irrigated areas. Occasional patches are devoted to odd or unusual crops, such as tumeric. Sugar beets are grown in several areas where factories have been established. The spinning of the cotton and processing of the tobacco are also done in local factories. Mulberries for silkworms are a major crop in certain areas, es-

pecially on the south shore of the Caspian where silk production is an important industry.

Of fruits and vegetables, there is a great variety. In Kouzistan and the hot lower valleys the date is the principal—and for many villages the only — crop. Fresh dates in Kouzistan are remarkably fine. Of the mild-climate fruits, figs, pomegranates, citrus fruits of all kinds except grapefruit, quince, persimmon, and grapes both for wine and raisins are all grown in large quantities. The apple, pear, peach, plum, cherry, and apricot are also produced in abundance as well as small fruit such as strawberries and blackberries.

Of vegetables, the Persian melon is probably most extensively cultivated and reaches perfection here. Other types of muskmelon and watermelon are also grown. Cucumbers, cabbage, cauliflower, eggplant, tomatoes, spinach, leeks, onions, beans, peas, carrots, sweet corn are all abundant, but only small amounts of asparagus and rhubarb are grown. Potatoes are grown only in the cooler areas.

Forage crops are not grown to any extent in Iran. The climate is such that sheep, work oxen, camels, asses, and their few small dairy cows can pick up a living outside during the entire year and little attention is paid to feeding stock. While alfalfa is said to have originated here, but little is grown now. The alfalfa weevil is bad in most districts, and since hay is cut with a hand sickle it is impossible to clear a large area at one time so as to expose the weevil to the sun to kill it. For this reason, shabdar (Persian clover) and sainfoin, which are not attacked by the weevil, are usually preferred.

On the desert range land fat-tail sheep are the principal livestock, with smaller numbers of goats, camels, asses, and ponies. Work oxen and buffalo and dairy cows are usually pastured on the swampy lowlands. The fat-tail sheep is a peculiar animal which builds up a great disk of soft watery fat on its tail, amounting in some cases to 10 or 15 percent of the weight of the carcass. This fat serves the same purpose as the hump on a camel in enabling the animal to go for long periods without food or water. The mutton of the fat-tail sheep is not strong, which is said to be because the fat is concentrated on the tail rather than distributed throughout the carcass. The wool is coarse and long and especially adapted to the carpets for which Iran is famous.

The nomadic tribesmen who herd the stock in the hills are good horsemen and great fighters. Although when well armed—as they now are—they are really the best protection for Iran from out-

side invaders, they are rather dreaded by the peaceful valley farmers because of their frequent raids for robbery and slaughter.

The system of irrigation in Iran is unique in that most of the water comes from the mountains, not by reservoirs or surface diversions but by a system of laboriously constructed, unlined, underground tunnels called *kanats,* leading down from near the base of the mountain (where they tap underground springs) to the surface of the valleys below. Perhaps over 80 percent of the irrigation and drinking water of Iran comes from these kanats which enable villages and cities to be established in most hopeless looking desert areas.

Methods of farming in Iran are still as primitive as in Old Testament days. Grain is cut with a sickle and threshed by trampling oxen. A primitive wooden plow pulled by oxen is practically the only tillage implement and there are no cultivated crops in our sense of the word. Sugar beets are sown broadcast like wheat and dug with a spade. I have seen mixed plantings of castor beans, cotton and sugar beets all sown broadcast in the same field and each plant tended individually where it happened to be. The farmers work squatting on their heels, rather than standing up. The ass is almost the only means of transport for short hauls. In order to increase their production per man and improve their general standard of living, the Iranians have much need for our modern equipment, but modernization should be undertaken gradually and accompanied by more extensive irrigation development (which is possible) in order to avoid throwing many people out of work.

On the other hand, we can learn much from the people of Iran in the art of handling small quantities of water with little waste and especially in the art of getting water from buried springs near the base of seemingly dry mountains.

Give 'Em Air!

Condensed from Successful Farming

H. B. White

Agricultural Engineer, University of Minnesota

THE stable, that portion of the barn occupied by the animals, seldom shows the first signs of poor ventilation but in the mow, on the hay, and on the roof boards, thick layers of frost are the danger signals that all is not right with the ventilation of a particular barn.

If frost or moisture forms on the walls of the stable it is usually necessary to make the building warmer by additional insulation. If the barn is of lumber construction, it may be that a covering on the outside will be the easiest improvement to make. Shingles or siding of various materials will not only stop loss of heat but also stop wind from blowing thru the walls. Drafts and dairying don't go together.

Masonry walls in cold climates need to be more than a single unit thick or have a lining of material that does not conduct heat so rapidly as tile, concrete, or stone, Inside sheeting may be applied to vertical strips on the inside of masonry walls. This is the same treatment as is given frame construction when sheeting is applied to the inside of the studs. It helps to keep the wall dry because a vaporproof paper is used on studs or strips before applying the inside sheeting, and here's an improvement that can be made quickly—and more cheaply than many.

The appearance of frost on the windows is not an indication that the barn is damp. It shows that ordinary window glass is not a good insulating material and if one wishes to save precious animal heat, storm sash, especially on the north and west windows, will make the barn warmer.

If the walls of the stable are covered with ice after a cold spell, the walls need more insulation, but in many states in a barn with a mow above the stable, the moisture does not do any harm to the animals or walls put passes away up stairways and hay chutes and shows the first signs of poor ventilation by mold on the hay and decay of framing and roof boards. Layers of frost on roof boards indicate that the moisture is not being removed from the building and may warp and rot out roof decking in a hurry.

With window ventilation, it is

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often found necessary partly to close the windows at night in order that the stable will not be too cold about sunrise when the coldest period occurs. Windows opening in at the top and with shields to prevent direct entrance of cold air may serve fairly well if not left open too wide in cold spells. One thermometer inside the stable and another outside will help to guide you in controlling any hand-operated ventilating system.

Outtake flues have been developed which help to control the moisture removal from stables and to keep air circulating. On high barns where the mow is above the animals, a flue built like a tall chimney has a very good draft and needs much less attention than do window ventilators. If these flues are carefully located and constructed they will carry the moist, light air out of the building and thus prolong the life of the structure and the loss of quality of the hay. A cow breathes off several pounds of moisture per day and this moisture absorbed by the air—warmed by the cows' body heat—takes a free ride. Outside air comes in by virtue of its slightly greater weight and forces the warm, moist air (air expands with heating) up the flue just as the smoke is forced up a chimney.

If air at 0° Fahrenheit is brought into a stable and warmed to 40° it will be able to absorb about four times as much water as it carried into the barn.

Outtake flues are more dependable if away from the outside walls of the barn. The moist air should not be cooled going thru the mow or there will be condensation before the air is discharged above the room where, in our country, it looks like smoke or steam on a cold winter morning. Much of the difficulty of gravity ventilation, as this system is usually called, is the attempt to make the roof outlet at the ridge of the barn. Owing to the hay carrier track installation this is not easy to do and all crooks and contact with the roof slow up the movement of this air.

Remember, here, that the ventilators on the ridge of most barns are to remove the moisture from the mow only, together with warm air in summer, and though they help, they do not do as good a job of moisture removal from the stable below the mow floor as is needed in many barns.

At the present time the thermostatically controlled, electric-fan type of installation may not be generally available. These systems are being used more and more and should you own one, for heaven's sake don't neglect it. When properly serviced, these systems are considered more dependable then the gravity system, especially in mild weather. They

may be installed without flues thru the mow, and this in emergencies or remodeling is an advantage.

Some barns do not have intakes and depend on air leaking in around doors and windows just as in many houses.

If you do any remodeling to put your barn into wintertime, wartime shape, perhaps the emphasis should be made on a good straight outtake flue extending vertically all the way thru the mow and three feet or more above the roof. Homemade flues have been constructed in various ways and workmen usually build a small roof over the top but many are working better that end like a chimney, with no roof of any kind. Thru the mow, lumber to give strength may be used outside, a layer of roofing or other airtight paper should be placed inside this, and a layer of insulating board or lumber for the inside.

There seems to be less adjusting to be done, and regulating of the damper which should be in each outtake flue, if the flue extends a few feet below the ceiling. Each barn may be somewhat individual but if the flue extends down to within 18 inches of the floor, warm air is trapped near the ceiling and thus serves to slow up quick changes of temperature in the stable when outside changes occur. Sometimes the extension down toward the floor may be removable and used only during the very coldest months. Some very warm barns may not need such an extension.

The location and size of outtake flues is well understood and the advice of your state college should be followed, but local conditions such as trees may cause considerable variation. Barns with a mow above the stable are usually ventilated with little difficulty. Generally, the installation of gravity outtake flues is best worked out on the two-story barn where about one square foot of cross-section of flue is allowed for five cows.

Each stable is a separate study when it comes to location of gravity outtake flues. One plan has the two flues located just outside girders that support the mow floor joist and in pens where they will not be in the way. If the barn had been shorter, one flue only would suffice. The location of the one flue in the west slope of the roof insures good results where winter winds are from a westerly direction.

Intake flues when installed, as in barns with masonry walls, need not be large but should open on the outside of the wall near the bottom of the windows and discharge near the ceiling on the inside of the stable. They should be arranged to close tightly in cold spells. Their total area need

not be over one-fourth the area of the outtakes.

In most cases the system in any barn will need to be regulated in changing weather. A damper in the outtake flue is the commonest regulating method. Intakes may need to be closed in cold weather. When it turns mild suddenly it may be necessary to open a door in the outtake flue at the ceiling of the stable to draw off the warm, moist air.

Most dairymen have ventilation systems of some kind. If they've worked satisfactorily in the past and you have no more animals in the stable room than previously, your only job is to check over the system for stoppages and then settle back in the confidence that you can beat Winter at his own game. If you've added a few head of livestock, it's time to go into consultation with the figures on the square footage of your inlets and outlets and see where you stand.

Controlling Field Mice in Orchards

Condensed from American Agriculturist

W. Robert Eadie

The field mouse, one of our most abundant small mammals, is universally distributed throughout the Northeast and no mammal, except the common rat, causes so much economic loss to agriculture as does this mouse. It feeds extensively on crops in field and garden but its outstanding damage is seen in orchards where it kills or seriously injures thousands of trees annually by eating layers of bark from the base of the tree.

To control field mice successfully and intelligently, their habits must be known. Field mice may be found wherever grass or similar vegetation grows, for they are primarily eaters of grass. In addition to the typical gnawing teeth of a rodent, they possess a set of ever-growing, flat-topped molar teeth for grinding up the abrasive grasses which are chopped into short lengths in preparation for eating.

Field mice live largely in surface runways that extend in a complex network through the vegetation and surface litter; but for shelter and refuge, they also dig small burrows and tunnels through the soil. Their globular nest of woven grass is sometimes on the ground surface, but often is a few inches or more beneath the surface. The young are usually born in these underground nests but may be born in the sur-

face nests. As many as eight or nine litters may be produced in a single breeding season, from March to November. The average number in a litter is about five and these young mice are themselves ready to breed within two months. In years of great abundance, some may breed throughout the winter.

It has been shown that field mouse populations in any one region rise and fall in a rhythm of three or four year intervals.

Tree-girdling by mice is most prevalent during late fall, winter, and early spring when succulent green vegetation is at a minimum. Consequentliy, active control operations should be conducted after the harvest in early November, before the first snowfall. Also, the orchard should be examined during open periods of winter when snow may be off the ground, and if mouse signs are still abundant the control operations should be repeated.

The methods of controlling field mice in orchards are both preventive and active. Among the preventive methods is the use of mechanical protectors around the trunks of the young trees, and among the effective active methods are trapping and poisoning.

Galvanized half-inch hardware cloth, 24 inches wide, is most commonly used to form a cylinder large enough to allow for the growth of the tree over a period of several years. This cylinder should be sunk into the ground as deeply as possible, for mice often do their damage at or slightly below ground level. Substitute materials that may be used for mechanical protection are newspapers and burlap. These substitutes *must* be removed each spring, for they harbor insect pests.

Clean cultivation in the orchard is an effective preventive method of mouse control for mice will not be found where surface cover is absent. A permanent ground cover furnishes ideal conditions for mice. However, scraping the vegetation and surface litter away from the base of the trunk for 2 or 3 feet to expose the bare soil helps greatly to lessen the possibility of damage. Sand, cinders, or similar material may be placed about the tree base. In the sod orchard, frequent mowing helps to discourage mice by removing both food and cover.

Trapping is of use only in small areas of an acre or two, such as a small orchard or garden. Fifty or more ordinary snap-back mouse traps should be used; fewer traps are ineffective. These traps are set in the runways of the mice at right angles and are baited with a pinch of oatmeal sprinkled on the pan of the trap. Peanut butter also may be used as an effective bait. The traps should be reset daily, and the

locations changed every few days.

On large areas the only effective active-control method is poisoning. The success of this method lies in its application. In recent years the Fish and Wildlife Service, Division of Predator and Rodent Control, has developed an inexpensive field-mouse rodenticide with zinc phosphide as the active ingredient. This prepared poison may be obtained only through an authorized source, usually the county agricultural agent. A fine grade of powdered arsenic is an effective poison for field mice when used properly. This may ordinarily be obtained from any good drugstore at a small cost.

For either poison, the bait is prepared in the same way, and this should be done outdoors. Firm apples or carrots are cut into approximately half-inch cubes. A 2-inch layer of these is placed in an enamel pan. The poison is sifted over them while stirring until an even, light coating is obtained. A large salt shaker, kept for that purpose, may be used to dust the arsenic on the bait. The zinc phosphide comes in a shaker-top can. An ounce can of the zinc-phosphide rodenticide will prepare about 20 quarts of bait, while 1 level teaspoonful will prepare 1 quart. One pound of the powdered arsenic will prepare 3 or 4 pecks of bait. Fresh bait should be prepared daily. One peck should treat 4 or 5 acres if the baits are carefully placed.

The poisoned baits should be distributed, one at a place, in the mouse runways or trails and in the burrows. Unless this is done, much of the bait will be wasted. *One should never handle the baits with bare hands* but should use a pointed instrument, such as an ice pick, to place the baits. Every bait should be under cover of some sort to exclude other animals, including birds. A handful of mulch or dead grass may be used to roof the bait station. Three or four baits around a tree and one bait every 10 feet between rows should be effective.

The bait should be distributed on clear sunny days, and in the mornings, to leave the area undisturbed during the afternoon. The field mice have an active period in the afternoon and it is best that they find the fresh baits. One should not neglect the borders of the orchard for these often provide excellent cover for concentrations of mice.

Under natural conditions field mice have many enemies. Among these are hawks and owls, skunks, weasels, foxes, and some snakes. These animals, if encouraged, will prove a valuable aid to the orchardist in reducing the mouse population. Posting the orchard and adjacent lands against trapping helps to conserve some of these animals.

Hoeing Cotton with Fire

Condensed from **Farm and Ranch**

J. Winston Neely and Sidney G. Brain
Delta Branch Experiment Station, Stoneville, Mississippi

WITHIN the last decade considerable work has been done in developing a mechanical device for killing weeds and grasses in cultivated crops with a flame. The principle of the process is based upon the adjustment of a very hot air-blast flame so that it can be drawn by a tractor along rows of crops and will kill the weeds and grass by flaming the leaves. The differentiation in burning depends upon the cultivated plant being tall enough to escape exposure of its leaves to the flame and the adjustment of the intensity of the heat and time of exposure so that the stems are not affected.

The equipment is mounted on a two-wheel sulky. On the platform is a 20-gallon tank for Diesel or tractor fuel; a 45-cubic-foot air compressor; and a 6-horsepower air-cooled gasoline motor. Attached to the front end of the drive shaft of the compressor is a fuel pump. Above each burner is attached a small tank, from which fuel is slowly fed to a pilot light. The height of the burners above the ground is controlled by sleds, one for each burner. The burners are adjusted so that two flames hit the rows from opposite sides and in tandem. Two rows are flamed at one time, four burners being employed. The burners are controlled by regulating valves on the air and fuel lines. These valves are, by necessity, located near the burners. The person who regulates the burners either walks behind the equipment or rides on the platform of the sulky. Labor required consists of a tractor driver and a careful, intelligent person to keep the burners operating properly.

During the 1943 season one of these machines was tested experimentally at the Delta Branch Experiment Station in an effort to determine its effectiveness in controlling weeds and grasses, its effect upon yields, and its adaptation to the production of cotton in the Yazoo-Mississippi Delta.

An experiment was set up in which four treatments were tested. The experimental design consisted of six series of four-row,

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1/27-acre plots, arranged in simple randomized blocks. The two center rows were harvested for yield determinations. The four treatments were:

Cultivation — no hoeing — no flaming

Cultivation—no hoeing—flaming

No cultivation — no hoeing—flaming

Cultivation—hoeing—no flaming

All plots germinated on May 12 and were plowed three times and thinned and hoed once before the test was started on June 12. The cotton was 6 to 8 inches high at the beginning of the flaming experiment. Each of the plots was heavily infested with grasses and weeds, principally crabgrass, watergrass, and careless weeds *(Amaranthus)*.

The cultivation—no hoeing—no flaming plots were cultivated June 15 and July 6 with sweeps on a walking cultivator. No additional effort was made to control weeds in the drill. At the time that the first picking was made, the cotton plants were completely "wrapped" in crabgrass, watergrass, a species of panicum, morning glory, and two other types of "tie vines." Some nut grass and an occasional plant of Johnson grass were found.

The cultivation — no hoeing—flaming plots were flamed on the beds on June 12, June 15, June 22, June 25, June 28, and July 2. The first four flamings were required to kill the mass of weeds and grasses at the beginning of the test. These plots were plowed on June 15 and July 6, but no hoeing was done after the test was started. At the time of frost the plots were practically free of weeds; only an occasional plant of crabgrass and morning glory and a very small amount of nut grass were found.

The no cultivation–no hoeing-flaming plots were flamed on the beds on June 12, June 15, June 22, June 25, June 28, and July 2. The first four flamings were required to clean the plots, since the test was started with heavy weed and grass infestations. The middles were flamed on July 2. No hoeing or plowing was done after the test was started. There were fewer weed and grass plants at the time of frost in these plots than were found in the cultivated plots.

The cultivation — hoeing — no flaming plots were cultivated on June 15, and on July 6, and were hoed on June 14 and July 7. A very large amount of weeds and grasses was removed in the first hoeing, and a considerable amount in the second hoeing. These plots were handled in the same way as the general crop, and the treatment may be considered as a regular plantation

practice. The amount of weeds and grasses at the time of frost was small, but probably more than occurred in the flamed plots.

Yields of seed cotton for the four treatments are given in the table on the next page. Under the conditions of this experiment, no significant difference between the plantation practice and the flaming alone treatments or between the plantation practice and the cultivation and flaming combination treatments was obtained. A significantly smaller yield was obtained from the plots in which the weeds in the drill were not controlled than was obtained from the other three treatments.

Late in the season, on July 3, several acres of check-row or cross-cultivated cotton were flamed with the machine, and the results obtained indicated that it is particularly suited to this type of cotton farming, and it is very probable that the machine could be adapted to eliminate practically all, if not all, of the hoe work. Flaming probably could be substituted for late plowing, which is done primarily to provide clean fields at picking time and which is frequently harmful to heavily-fruited plants.

The burners use 4 to 6 gallons of Diesel fuel per hour, and the air compressor one half gallon of gasoline per hour. When grass and weed plants are 2 inches or smaller, the machine can be operated at a high rate of speed, and 20 to 25 acres can be flamed in a day with a two-row outfit. As the grass plants become larger, the speed must be reduced considerably, and probably 15 to 18 acres would require a day's operation. The cost of operating the machine is 35 to 50 cents per hour and 15 to 35 cents per acre. At the time that the experiments referred to above were started, the plots were badly infested with grasses and weeds, and 24 hours of labor per acre were required to hoe these plots. Four flamings, over a period of two weeks, accomplished the same results in adjoining plots, the cost being $1.40 per acre, exclusive of the costs of operating the tractor and of the operator who controlled the burners. The second hoeing required twelve hours per acre, and similar results were accomplished with two flamings, over a period of five days, at a cost of 55 cents per acre, exclusive of the tractor and labor costs.

Results obtained indicate that flaming of cotton 6 inches or taller will satisfactorily control weeds and grasses and will not affect the production. Before definite conclusions can be drawn and unconditional recommendations made, it will be necessary to conduct the tests during more than the one year it has been in progress. During the experiment, one to two flamings killed practically all

weed and grass plants 2 inches or shorter in height. Continuous flaming for three to five times killed large grasses with the exception of Johnson grass, but had no effect upon large upright weeds. Morning glory vines, even of considerable size, were very susceptbile to the flame. Nut grass, because of its reserve food, is not eliminated in a single season, but its growth is definitely checked by only one flaming; continuous flaming apparently will hold it back much more effectively than will hoeings of the same frequency.

Total yields of seed cotton from four treatments in a weed-control experiment, Stoneville, Mississippi, 1943, six replications, two center rows of four-row plots

Treatment	Seed cotton per acre
	Pounds
Cultivation—no hoeing—no flaming	1506
Cultivation—no hoeing—flaming	2130
No cultivation—no hoeing—flaming	2033
Cultivation—hoeing—no flaming (Plantation practice)	2141
Difference barely significant	196
Difference highly significant	271

Experiment Station Goes to Farm

Condensed from The Progressive Farmer

J. Francis Cooper

Editor, Florida Extension Service

MANY farmers in western Florida are obtaining better yields of corn, cotton, peanuts, velvet beans, and other crops because of the work during the last two years of two mobile units of the Florida Experiment Station.

These mobile units, which were established by the 1941 Florida Legislature and are a part of the North Florida Experiment Station at Quincy, are designed to serve counties having red clay subsoils.

One unit, in charge of Russell W. Wallace, has headquarters at Monticello and serves Madison, Jefferson, and Leon counties; the other, directed by Ralph L. Smith and centered at Milton, works in Okaloosa, Santa Rosa, and Escambia. They maintain no offices, and their only laboratories are in the fields of cooperating farmers.

The units furnish all fertilizer, line out materials, seed, and extra labor required in harvesting crops grown in their test plots. The

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co-operating farmer furnishes the land and regular labor required in growing the crop. The units work with big estates, average farms, FSA clients and Negro tenants, thus giving all classes of farmers an opportunity to benefit.

The winter crops — oats, clovers, lupine, Austrian peas and vetch — are under test for the second winter and are proving of widespread interest. Quincy Red and White (or Quincy 1 and 2) oats and Florilee, another and newer variety developed at Quincy, are attracting widespread attention.

Both units are encouraging the seeding of blue lupine, since it has proved such an excellent soil builder and matures seed here. Last fall Mr. Wallace tried seeding lupine on runner peanuts as the nuts were harvested on several farms in Jefferson, Madison, and Leon counties. Both fertilizer and inoculated lupine seed were sowed just ahead of the plow. It worked well in western Florida and southern Alabama and Georgia in 1942, when the season was favorable.

In addition to testing the winter covers Mr. Wallace is pushing a plan of seeding lespedeza on oats between Feb. 15 and Mar. 15, letting cows graze the oats, and then the lespedeza will come on and furnish summer grazing. In the fall, he will disk and reseed to oats. Before planting lespedeza, he fertilizes with a ton of limestone and around 500 pounds of superphosphate and 100 pounds muriate of potash per acre. Common and Kobe lespedezas have proved best.

More cheap feed for livestock will be stressed, and tests will include both clovers and grasses. Fertilizer studies will seek the best plant food ratio for pastures. Two new grasses, Digitaria and Coastal Bermuda, are showing up well.

Both the Milton and Monticello units have found that practically all lands in the two areas respond to potash, as well as to phosphate and nitrates. Most farmers now use a 4-8-4 or 3-8-5 and Mr. Wallace believes they will soon come around to using a 4-8-8 for both cotton and corn.

Sulfur dust to control leafspot on peanuts has increased yields more than any fertilizer.

Repeated tests with improved varieties properly fertilized have shown that corn yields can be increased from 1 to 30 bushels. The new varieties developed by the Experiment Station, Florida W-1, the hybrid, Florident Yellow, and Florident White, are yielding 40 bushels to the acre right along when properly fertilized.

From $1,850 to $10,107

Condensed from Hoard's Dairyman

Joe Steiner makes a living milking cows. Dairy farming is his business and he runs his farm on a business basis. Here is a story of how be built up one of the greatest Holstein herds in the nation.

Steiner has a background of practical experience that dates from the time he was a boy of ten on his father's dairy farm nestled in a peaceful valley of the Alps, at Benken, Switzerland. As a youngster, Steiner attracted the attention of a French cattle buyer who offered him a position on a French dairy farm, but before accepting the offer Steiner was persuaded to come to America by a friend who painted glowing pictures of the wages paid dairymen here. Steiner landed at Lewistown, Montana, and became a milker for the Lewistown Dairy Company. In 1913 he became herdsman for Burke and Hofstetter, also of Lewistown, and in 1916 became a part owner after buying out Burke. In 1919 he sold his interest and in the spring of 1920 bought a herd of 72 cows at Billings and rented the 7X Dairy.

As owner of the 7X herd, Steiner found that taking care of 72 cows, retailing milk, and farming on a fairly large scale was a real task. There was little time for experimentation with some of his ideas. He was satisfied with production and thought he had a pretty good bunch of cows. Now, however, after 19 years of cow testing, he admits that they "were a very common bunch such as may be picked up most any place."

The fall of 1924 is regarded by Steiner as his turning point. The Yellowstone County extension agent had called a series of dairy meetings to consider the advisability of organizing a cow testing association. Steiner felt that he had about the best herd in the district; that he would get little, if any, benefit by joining the association. However, he was convinced that cow testing was extremely worthwhile to the Billings community, if not for him, and joined. The association was formed and Steiner became the first president. The herd which he thought was so good took a big drop in his estimation in the first year of testing. In his own words he says, "Before the year was up I was the laughing stock of the community. My herd, in place of being near the top of the list as I expected, proved to have

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a very low average. This was an eye-opener for me and I often laugh when I think back to that herd and the erroneous ideas I had regarding testing and feeding."

The poor showing of his herd caused Steiner to do a lot of thinking. He resolved to start immediately to increase production. The objectives of the cow testing association were higher and more economical production. This meant culling to get not more, but better, cows. Steiner culled and has been at it ever since. Just how wholeheartedly he has adopted culling is shown by his own recent statement, "In my herd, all heifers that do not make 400 pounds butterfat during their first lactation period are immediately discarded." In the beginning, the quickest way to get a good herd, in Steiner's opinion, was to cull out the older low producers. This was a drastic cure, for a young cow's production is low. However, he was satisfied with production before he joined the association and felt he could cull severely even if he did show a little production drop at first. That is exactly what happened. The herd averages for the past nineteen years are as follows:

Record of the J. C. Steiner Herd

Years	No. of cows	Ave. fat production	Value of product	Cost of feed	Return above cost of feed per cow
		Lbs.			
1924	40	287.3			$ 46.25
1925	36	274.3			
1926	38	263.9			
1927	34	286.5			
1928	33	302.6			
1929	37	334.0			
1930	33	337.6			
1931	35	507.1	$150.90	$ 73.16	77.74
1932	32	516.0	155.00	59.00	96.00
1933	37	551.0	183.00	58.00	125.00
1934	32	541.0	217.00	84.00	133.00
1935	39	526.0	215.00	107.00	108.00
1936	42	465.0	232.00	90.00	142.00
1937	42	500.0	300.00	103.00	197.00
1938	40	591.0	354.00	82.00	272.00
1939	40	614.0	315.00	79.00	236.00
1940	40	559.0	334.00	87.00	247.00
1941	45	561.0			

Culling is not by any means the only factor involved in this phenomenal increase in production. During the seven years from 1924 to 1930, Steiner was farming 400 acres of irrigated land and his dairy herd was a side issue to which he was able to give little personal time and attention. The cows were fed alfalfa hay and grain during this period and were grazed on irrigated pasture during the summer. They were milked twice daily and were handled almost entirely with hired help. In 1930 Steiner decided to devote all his time to dairying and give his cows the personal attention he thought they deserved. One reason that caused this decision was that in 1926, in cooperation with the Huntley Experiment Station, he had started using sons of proved sires on the herd. He was convinced that the change from general farming to dairying with more time for better management and feeding, and with three time milking, would pay bigger dividends. Consequently, he reduced farming operations to 130 acres on which he produces, at present, alfalfa hay and a limited supply of corn and green fodder.

The results of the past eleven years have convinced him that this decision was worthwhile and led him to conclude that herd records are made and maintained only by close personal attention and care, and by a carefully planned breeding and feeding program. The breeding program is based on the exclusive use of sons of proved sires, and all bulls used in the herd since 1926 have been secured from the dairy herd which has been developed with proved sires at the Huntley Experiment Station, Montana.

Steiner believes there is no better or quicker way to achieve high production than to breed for it, and in connection with such a program to establish a high standard and then cull out all females that do not reach that standard. His herd averaged 561 lbs. for the past 11 years. (Note: These are 365-day, 3-time-a-day milking records. Regular DHIA records are based on 305-day, 2-time milking. A 600-lb. record on 365-day, 3-time basis is comparable to approximately a 416-lb., 305-day, 2-time record.) Steiner likes big, growthy heifers with plenty of substance. He wants smooth, typy heifers too, but believes that production at the pail is what counts for more than show ring conformation, and that the life of a commercial dairyman is too short to attempt to blend high production and perfect body if one's only source of supply is his own original herd.

In 1939 the 7X herd of 41 cows produced an average of 16,211 lbs. milk and 614 lbs. but-

terfat, their highest record. The lower production since that year has been due, according to Steiner, to a change in his breeding program. Up to and including 1939, all heifers had been bred to freshen at from three to three and a half years of age. Starting with 1940, all heifers have freshened from 22 to 27 months of age. Heifers freshening at from three to three and a half years developed into big 1,600 to 1,800-lb. cows that had a tendency to go bad on their feet. There were more "shy breeders" among these larger cows than among those that had freshened at around two years of age and they developed into 1,400 to 1,500-lb. cows.

As an example of body weight in relation to production, he has one 16-year-old cow now in the herd weighing only 1,350 lbs. that made 635 lbs. of butterfat this year. Also, there were each year ten to fifteen of these 2-year-old heifers that had to be carried on feed for a full year without producing. While the 2-year-olds won't produce as much as the 3-year-olds during their first lactation, Steiner believes that there is greater economy in this new breeding program.

The availability of various feeds makes his feeding program more of an individual problem. There are certain principles, however, that he kept in mind in his effort to get high production at a low feed cost. He realizes that the dairy ration must contain all the nutrients, minerals, and vitamins needed for maximum growth and milk production, but has always tried to use farm feeds and reasonably priced by-products that contain all of these essential ingredients. High protein concentrates such as cottonseed meal, linseed meal, or soybean meal have never been fed. He believes that alfalfa hay or any other good quality green protein roughage can furnish enough protein and vitamin A and calcium for dairy cows. He has always used mill feed which is a mixture of wheat bran and shorts, chiefly because of its high phosphorus content and because it has proved to be a low priced concentrate in his locality.

During the past eleven years, Steiner has used little or no grain, but has fed liberal quantities of wet brewers malt, dried beet pulp, and beet molasses. Then, each year, during the fall and winter months he feeds sweet corn fodder. Since 1934, when he began feeding wet brewers malt, the cows have not been on pasture during the summer but have been on a dry lot ration the year around. The typical ration is as follows:

During the fall and winter: 30 lbs. wet brewers malt, 30 lbs. green corn fodder, 12 lbs. alfalfa hay, 6 lbs. mill feed, 7 lbs. dried

molasses beet pulp, 2 lbs. beet molasses.

During the spring and summer: 40 lbs. wet brewers malt, 15 lbs. alfalfa hay, 6 lbs. mill feed, 8 lbs. dried molasses beet pulp, 3 lbs. beet molasses.

Though the above rations are typical, Steiner's cows are always fed individually on the basis of the amount of milk they produce. He realizes that every cow is different in the amount of grain she can safely and profitably consume. With the above ration Steiner estimates the feed cost per 100 lbs. milk produced has been about 49 cents, and the return per dollar expended for feed has been $2.96. Steiner does not claim that this ration is perfect but knows it has proved very satisfactory. He states that we still have much to learn about how to make up a perfect ration, but he prefers to find this out by feeding the widest possible variety of farm grown feeds and reasonably priced by-products.

Steiner is convinced his summer pasture contains essential feed nutrients that are especially important to avoid breeding trouble in a high producing herd. For this reason he is going back to the use of tame irrigated pasture as a part of the summer ration, using about fifteen acres for the milking herd and ten acres for the young stock. Sweet corn fodder, fed green, in the fall and into the winter, gives an additional supply of these essential nutrients.

Summarized, the vital factors of management that are essential for high production involve regularity of feeding, milking, and handling. Steiner believes that the sudden and continued improvement which started in his herd in 1931 and has continued since has been due to his effort to concentrate on the best known methods of breeding, feeding, and handling his herd to produce the most economical results.

Guar—A Summer Growing Legume in Arizona

Condensed from Seed World

Ian A. Briggs

Associate Agronomist of the University of Arizona, Tucson, Ariz.

ARIZONA is a state that does much pioneering in the growing of unique and unusual crops. Such a crop is guar, still somewhat of a tenderfoot among the crops of this state.

It so happened that Italy's participation in the war cut off the supply of carob beans and carob bean products. The mucilage derived from the carob bean is considered practically indispensable in the manufacture of better grades of white paper. There was a frantic search for a substitute product which could be produced in the United States and very fortunately it was found that the seeds of the guar plant contain a mucilage of excellent quality and in sufficient amounts to serve the purpose.

What is guar? It is a summer growing annual legume varying in height from three to five feet. The flowers are not conspicuous and the seed pods which are about three and a half inches in length are borne in clusters along the branches. The plant seeds abundantly and *unlike* many legumes in the irrigated Southwest it retains the seed for a long time, even several months, after they are ripe. This is a great advantage as it permits the seed to be harvested with a combine which keeps the cost production fairly low. Guar has been used for a number of years as a green manure or soil building crop by a few vegetable growers in the Yuma Valley. It has been compared with four other green manure crops and with summer fallowed land on the Salt River Valley Experimental Farm at Mesa for the past three years. Barley has been used as an indicator crop and each year has given higher yields following the guar than was the case when sesbania, Tepary beans, cowpeas, crotalaria or summer fallow were used. There is a great deal of interest in guar for soil building purposes because the supply of sesbania seed is becoming more scarce all the time and is high in price since it is all hand harvested. The rela-

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tively new guar plant, a native of India, gives promise of becoming the most important summer growing green manure crop of the irrigated Southwest. However, the principal interest in the plant at the present time is the possibility that it may become even more important as a source of mucilage for the paper industry with other possible uses as well.

S. B. Detwiler, In Charge, Hillculture Section of the Soil Conservation Service, came to the Agronomy Department of the University in February, 1942, and asked to see all of the rather unusual or little known legume seeds which might be at hand. He discovered in some guar seeds the peculiar type of endosperm which indicated that seeds of this plant might be used for the production of mucilage. Upon his recommendation, the Institute of Paper Chemistry began experimental work with guar. The results were so encouraging that seed supplies of guar were increased in the summer of 1942. Seed plots were grown on the Salt River Valley Experiment Farm and other plantings there and at the Soil Conservation Service Nursery at Tucson, intended for use as green manure crops, were allowed to mature and were harvested for seed instead.

Grass Fed Steers Make Most Money

Condensed from The Southern Planter

Ralph E. Hunt

Virginia Agricultural Experiment Station

VIRGINIA does not have grain to sell. It does have an abundance of bluegrass to market. The Virginia Agricultural Experiment Station has been conducting some experiments to determine how best to utilize the bluegrass pastures with which the State has been so abundantly endowed.

Too many cattle from these pastures were going to market lacking the final finish the packers demanded and were, therefore, discriminated against. Believing that the manner in which these cattle were wintered had a very direct bearing on the gains made the next summer, a study was planned on the wintering of two-year-old steers. As a result of this research work, we found that the

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greatest yearly gains, from one fall until the next, were made by those cattle which were fed 40 pounds of silage per steer daily during the winter feeding period. This was just sufficient to maintain the fall weight during the winter. This amount not only produced greater yearly gains but it actually reduced the cost of winter feeding.

After determining that steers kept at a maintenance level during the winter months made greater and cheaper gains, our next problem was pasture supplementation. In our first attempt we fed 1, 2, 3, and 4 pounds of cottonseed meal per steer daily in addition to all the grass they would consume. We found that this amount of protein supplement did not increase the total gain. In fact, the steers which were fed this amount of protein supplement did not gain as much during the summer as did a group of similar steers grazing on comparable pasture without grain.

In our next attempt to supplement pastures we fed from 8 to 10 pounds of corn and cottonseed meal per steer daily in addition to what grass the steers would consume. The concentrate used consisted of 4 parts of corn and 1 part of cottonseed meal by weight. This was all the steers would consume on pasture. In this case the grain fed steers did gain slightly more than the steers that were given grass alone. But over a period of three years the additional gains were not sufficient to pay for the grain. The quality and finish of the cattle were almost the same. In order to make this supplemental feeding profitable, the grain fed cattle would have to sell for more than $1.00 per cwt. above the selling price of the grass fed cattle. It was impossible to obtain this difference in price.

At the close of the grazing period, we took some of these same cattle that had been grazed on pasture alone and put them in the feed lot and fed grain and hay for 8 weeks. Of course, we got some additional gain by doing this, but not enough to pay for the feed. Here again, it would have been necessary for these cattle to sell for more than $1.50 per cwt. above the selling price of the grass cattle at the close of the 56-day feeding period and this difference in selling price was not obtained.

Our next attempt was the feeding of supplemental concentrate feed to two-year-old cattle that were grazed on typical Southwest Virginia pasture. We thought perhaps this method would prove more satisfactory with the younger cattle than it had with the three-year-olds. The results were almost the same as they had been with the three-year-old cattle.

As a result of three years experimental work conducted at the

Virginia Agricultural Experiment Station, in cooperation with the U. S. Bureau of Animal Industry and the Bureau of Agricultural Economics, we found that beef produced from grass pastures alone and beef produced on a ration of corn, cottonseed meal, and mixed hay in the dry lot would grade the same in the cooler and would sell for the same price to the retailer. If the cattle are uniform in quality to start with, and if they are fed so as to make the same gain over the same period of time, they will have the same dressing yield. Steers that have been wintered on a maintenance ration will gain 2 pounds per day, or more, for a normal grazing season of 168 days. This is a satisfactory gain.

Having determined that beef cattle could be produced more economically on grass pasture alone than on grass plus concentrate, our next study was that of pasture improvement. Different pastures were fertilized with different fertilizers and some interesting facts were ascertained. The soil of Southwest Virginia is of limestone origin and the addition of lime to these pastures did not result in increased gains on the cattle which were grazed upon them. Phosphorus seems to be the limiting factor. The pastures that were fertilized with phosphorus produced as great gains as did those pastures which were fertilized with the same amount of phosphorus with nitrogen, or potash, or both. In one project the pasture used had, according to records kept by the owner, produced from 90 to 100 pounds gain per acre each grazing season. After this same pasture had been fertilized for two seasons it averaged 317 pounds summer gain per acre for the next four grazing seasons.

We are now working upon the problem of pasture management which has much to do with the economic production of beef cattle.

Of course, these results apply only to those areas in Virginia where the soil is of limestone origin and may, or may not, apply to the great area of Virginia which lies east of the Blue Ridge mountains. Our next study should be on pasture improvement and management in this eastern area where the number of livestock is constantly increasing.

Didn't Plow Sod Land

Condensed from Wallaces' Farmer and Iowa Homestead

THEY tell me that you raise corn on sod ground without plowing the land," a visitor said to C. D. Cutter, of Page county, Iowa.

"There's a field down there that was listed and cultivated twice," Cutter said, pointing from in front of the house. "That field on the hill also was covered only three times with the tractor, taking two rows at once. Those fields were in oats last year and a sweet clover catch crop."

Turning to a field near the house, Cutter explained:

"This field was in sweet clover pasture last year, and a big growth was left on it. We disked it, planted the corn with a two-row lister on June 16, and cultivated once. Three times over with a tractor there, too."

A little figuring disclosed that three times over with a tractor, cuting a two-row swath, traveling at two and one-half miles an hour, meant one and one-half tractor hours per acre to grow a crop of corn on sod land.

That is only about 43 per cent of the labor by the usual method, which would require about one hour per acre for plowing, one hour for disking, harrowing and planting, and one and one-half hours for the three cultivations, making three and one-half hours per acre in all.

"Let's go and look at the corn," said Cutter, pointing that way. The first field was a 14-acre strip contoured at the lower edge of the slope. There was a good stand, with relatively few weeds.

In a 130-foot row, a count showed 73 average sized ears, after allowing for nubbins. That should mean 73 bushels of corn per acre, if what were called average ears were big enough so that 100 would make a bushel. One row 130 feet long is one one-hundredth of an acre in a field planted with rows 40 inches wide.

Up on the ridge, where the rows were also contoured, the count showed 75 ears on a hundredth part of an acre, or 75 bushels per acre. "That doesn't seem to be off much, according to our yields last year," Cutter observed.

"We planted this field the 16th of June," he said, leading the way into the field near the house. "Here was where we disked the land before listing, but we only did that to make it so the lister would work in the loose trash.

"I thought we wouldn't get it cultivated at all," he explained;

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"but we got into it with the tractor after the combining was done —about July 15 or 16—and got it plowed once."

A count showed 93 ears on a hundredth of an acre. "It may yield 85 bushels if it gets ripe," said Cutter, "but the green ears may look bigger than they really are."

"Have you been wasting a lot of labor on corn?" the visitor asked, as the car was turned toward the home of Cutter's son, Tom R. Cutter.

"I don't know," Cutter replied. "We had to do it this way. I've been around here for about 70 years, and I wasn't able to get the mules out this summer, so Tom had to do it all with the tractor on more than 500 acres of land."

Cutter explained that he and his son used to use a sub-surface tiller ahead of the lister. This implement took two rows, cut the ground loose underneath and dropped it back the same side up.

Tom R. Cutter said he thought the sub-surface tiller should not be run more than two or three inches deep. The purpose is to kill the weeds and other growth ahead of the lister. It was a little hard to say whether the use of the sub-surface tiller paid, in view of the big crops produced this year, when shortage of labor prevented its use.

That brought up the question as to how much trouble the cultivator caused in land where sweet clover was listed under when the clover was anywhere from 18 inches to waist-high.

The elder Cutter said the green material listed under decomposed rapidly and caused little trouble in cultivation. More trouble was had on land that was left in sweet clover one year and dead stalks and trash remained on the surface.

The war-time rotation on the Tom R. Cutter farm is a two-year rotation, with oats and a sweet clover catch crop, followed by corn. The elder Cutter sometimes leaves the sweet clover for pasture, making a three-year rotation.

With this rotation, corn does not follow corn unless something happens to interfere with the rotation, like the heavy rains at oat-sowing time last spring. The fact that corn is always on sod ground, and that there is usually green manure turned under, has something to do with the big yields, of course.

And there is no place for the mold-board plow, with its high requirements in time and fuel, in this kind of farming. The only turning over the soil gets is with the lister, which turns about one-third the surface to a moderate depth, and takes two rows at a time.

How would this corn have compared with corn on land that had

been plowed and surface planted? On the USDA and ISC experimental farm, a few miles away, sub-surface tillage and hard-ground listing have been compared.

In 1943, sweet clover land that was sub-surface tilled and hard-ground listed yielded 68.2 bushels per acre, while plowed and surface planted corn yielded 73.7 bushels per acre, a difference in favor of plowing of 5.5 bushels.

However, the listed corn was a poorer stand, having only 90 stalks to 117 for the surface planted. In a year of plentiful rainfall, like 1943, this stand difference might easily account for the 5.5 bushels difference in yield.

The labor saving in growing corn on the Cutter farms was duplicated on the experimental farm. Those in charge of the experiment reported:

"Labor input and power requirement in preparing the seed-bed and planting were reduced one-third to one-half by use of various mulch culture implements, as compared with the requirements when the plow was used for primary seed-bed preparation."

Corn yields, however, on red clover sod did not compare so well as between listing and plowing. Surface planted corn made 91.2 bushels per acre and hard-ground listed yielded 64.4 bushels. Corn-stalk land yielded 70.5 bushels when surface planted and 62.7 when sub-surface tilled and hard-ground listed. The same stand disadvantage was encountered in the listed corn.

Results on the Cutter farm and the experimental farm seem to indicate that a way has been found to reduce labor in corn growing on the types of soil that can be listed. These types include the Marshall soils of western Iowa, eastern Nebraska and northwestern Missouri.

Experiments are being made to find out if the same labor saving can be made on other soils of the state. Perhaps the labor saving could be made by sub-surface tilling and surface planting on some soils.

In both yield and labor saving, disking and surface planting showed up well on the Clarion soils of central and northern Iowa, according to a 1939 test at Iowa State College. The test field was on land that was in soybeans the year before.

Plowed plots yielded 60.9 bushels per acre and disked plots 58.2 bushels—2.7 bushels less. It required about two-thirds as much labor on disked land as on plowed land.

Soldiers Wield Both Sword and Plowshare

Condensed from Florida Grower

Emmett Snellgrove

A TOUGH marine sergeant from Iowa strode up to last year's Christmas mess on a South Pacific island with only casual concern. He looked idly at the chow line, blinked, burst into a grin. There before him was a steaming heap of Iowa sweet corn. He pitched in. Even the folks back home didn't have roasting-ears for Christmas.

The corn came from the little-known battlefield gardens that are growing in the rich gumbo and volcanic soils of our distant military bases. In the south Pacific, where thousands of our fighting men are cultivating their own gardens behind the front lines, the total yield will exceed 150,000 tons of food this year. The value of this food, running into millions of dollars, is small as compared to the well-being of our overseas troops when they get fresh vegetables grown from the same kind of seeds that grow in their mothers' Victory gardens.

And on the other side of the world, thousands of American soldier prisoners behind the German lines are also enjoying fresh vegetables grown and harvested on the spot with seeds sent through the American Red Cross. The War Food administration and the Red Cross supplied the seeds, with explicit instructions for cultivating, and also provided the necessary gardening tools. The 15,000 pounds of seed—shipped in some 4,000 small packets containing 3 or 4 pounds each—are insignificant compared to the millions of pounds grown annually in this country, but they are enough to supply fresh vegetables for 400,000 men.

The constant flow of seed supplies from the United States is today affecting the lives of millions of people in scores of places around the world. Since March, 1941, we have shipped abroad 105 million pounds of vegetable and field seeds. During the twelve months ended July 1, 1944, WFA exported some 18 million pounds of vegetable seeds to thirty-one countries and Territories. This quantity, only about 5 per cent of United States vegetable-seed production, in the lands to which shipments have been made often has meant life itself. In England and Russia, for example, relief agencies have provided nearly 200,000 destitute families with

Reprinted by permission from the Florida Grower, October, 1944

enough American seeds to plant their own gardens for harvesting this summer.

The economy of shipping seeds to our armed forces abroad, and our allies, is obvious when we consider that the 14,000 pounds of tomato seeds which were scattered over five continents produced 194,000 tons of food, and that 7 million pounds of bulkier bean seeds produced 117,000 tons.

If all the 18 million pounds of seeds could have gone at one time to one destination, a single 10,000-ton cargo vessel could have carried them—with enough space left over to carry a thousand or so tons of other strategic materials. On the other hand, had we shipped the *food* produced from these seeds, it would have required the entire available space on 900 such ships. At current prices, these seeds would produce about 2 billion dollars' worth of food, but the seeds cost only about 6 million dollars.

The year's largest combined total of seeds—about 4½ million pounds — went to Russia. The smallest shipment—35 pounds—went to Ethiopia. Between these high and low figures varying quantities were shipped to England, Australia, north Africa, the West Indies, British East Africa, Nigeria, Ceylon, the Union of South Africa, French Cameroons, the Dominican Republic, Costa Rica, El Salvador, Panama, Brazil, Peru, Honduras, Sweden, New Hebrides, Martinique, Belgian Congo, Paraguay, Venezuela, the Virgin Islands, India, Cuba, Italy, and points in the south Pacific.

In addition, thousands of pounds were exported commercially to practically every other country not under Axis control. A small quantity, principally for experimental purposes, was exported through the Office of the Coordinator of Inter-American Affairs.

Russia and the United Kingdom have taken about half of our exports of vegetable seeds during the last year, preferring beans, beets, cabbage, carrots, cucumbers, onions, peas, and radishes. Yet despite all these shipments, we have ample vegetable seeds to meet our own expanded requirements at home.

WFA allocated 302 million pounds to all claimants for the fiscal year beginning July 1, 1944. The largest share will go to United States civilians, who will need about 92 per cent of the available supply for next year's estimated 5 million commercial acres and over 20 million Victory gardens.

United States vegetable-seed acreages are large this year, and harvests of most varieties are expected to reach all-time peaks. Many of the thirty-six varieties

(from beans to turnips) will, in fact, be in such good supply that substantial unallocated balances will be included in year-end stocks—to be drawn upon, if needed, for use in liberated areas or for requirements not now anticipated.

The four most important biennial seeds — beet, cabbage, carrot, and onion—were critically short until the 1943 season, but their production this year is expected to be sufficient to meet most if not all of current requirements. Moreover, there may be some reserves of cabbage and carrot seeds for stock-piling purposes.

Before the war, the United States was one of the world's leading seed importers. But these imports stopped abruptly when Germany invaded France, and it quickly became clear that we must produce seeds enough not only for ourselves but our allies as well. England's continental seed imports, cut off the same as ours, had ended just when she was beginning to convert her untilled acres to food production. Australia could not help England because she too was in desperate need. And when Germany captured the Ukraine, Russia had to import large quantities of seeds or starve.

This situation did not catch our vegetable-seed industry off guard. Even before war struck, representatives of the department of agriculture and the seed growers' industry had guessed the probable course of events, laid plans for large scale seed production in this country. Production increased from 124 million pounds in 1939 to nearly 350 million pounds in 1943. This foresight paid dividends. We could supply our allies with all the seeds they needed and keep an abundant quantity at home. And this year, with seeds perhaps going on to a bigger job in world rehabilitation, our production has been stepped up to an even greater tempo.

Even as vegetable seeds are essential in food production, field seeds are essential not only in the production of livestock feed but have definite military value, too. Legumes and grasses help feed our tremendous livestock population, which this year broke all records. In Russia thousands of acres have become pastures for great herds of livestock. And in England, and other countries, American fighting planes are taking off and landing every day on fields protected against wash and erosion by cover crops from American seeds.

Field-seed shipments to Russia have been mainly Austrian winter peas, soybeans, sorghum, and vetch, and to the United Kingdom orchard grass, Kentucky bluegrass, timothy, redtop, meadow fescue, vetch, and mixtures

of alsike clover and white clover. From 70 to 75 per cent of our orchard grass and a substantial portion of our meadow fescue have gone to the United Kingdom during the last three years. If present plans of the Russian, British, and French forces work out, thousands of additional acres freed from the Axis will be transformed into rich pasture lands.

For all purposes, our friends abroad have asked for approximately 60 million pounds of field seeds during the next twelve months. WFA, which believes that sending small seeds abroad to produce large crops makes good sense, and the American seed industry, which has already done such a remarkable supply job, are going to do their best to fill that need.

Ration Books for Cows

Condensed from Coastal Cattleman

British Ministry of Information

FEW farmers in America have ever even considered the idea of a rationing scheme for cows and other farm stock. They may be aware that in Britain meat and milk and eggs are all rationed but few know that the providers of these also have their ration books. Most American farmers would probably say such a thing would be impossible. Four years ago most British farmers would have agreed. In fact, British farmers went so far as to say that they wanted feed, not paper, and that they couldn't feed paper to stock. But a feed rationing scheme was introduced in Britain over three years ago and is still working well.

The Government and the farmers in Britain fully realized the difficulties of operating a feed rationing scheme. Necessity forced its introduction when supplies of some feeds and particularly of cereals and high protein feeds diminished rapidly. Either the stock had to be slaughtered indiscriminately or a plan worked out to give some classes of stock special priority. As one farmer put it, it was better to have a smaller number of stock properly fed than to have animals "walking about doing nothing but grow old."

The need for rationing came about in two ways. The first was a shortage of imported feed and

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the second was the need to produce in Britain every possible pound of food for humans at the expense of feed for animals. Before the war imports of feed into Britain exceeded 7 million tons a year including more than 3 million tons of corn. Restricted shipping facilities made the direct importation of feed virtually impossible and the only feed of overseas origin now available in Britain is the offals from imported wheat milled in the United Kingdom and oilcake obtained from imported oilseeds the primary purpose of which is to provide oil for margarine.

When it became essential to produce the maximum quantity of human food in Britain the long-standing agricultural practice had to be changed. Millions of acres of pasture land were ploughed up and planted with wheat, potatoes and other crops. But it was equally important to produce large quantities of one animal product—milk—in order to maintain the health of the children. A new agricultural balance had to be planned; this provided for the maximum output of food grains, vegetables and milk, and the adjustment of the livestock population to the supplies of feed which would be available. On the livestock side the dairy herd was given first priority while pigs, poultry and sheep were at the bottom of the list. Farmers were told to reduce the pigs and poultry to one third of the numbers existing before the war. Sheep received no priority and can only be fed on grazing which is unsuitable for other stock.

It would not have been practicable to ration all livestock feed or to requisition all feed grown on farms. The rationing scheme is designed primarily to deal with the feed which is normally purchased by the farmer, such as milling offals and oilcake. All wheat, barley and rye grown on the farm must be sold to the Government but the farmer may use his own home grown oats, beans and peas, although any surplus, must be sold to a Government buyer. Each farmer's program must be approved by his County War Agricultural Executive Committee and the permitted acreage of oats, beans and peas is determined partly on the number of dairy cattle on the farm but also on the national requirement for wheat, potatoes and other crops required for direct human consumption. At the same time farmers have been encouraged to produce maximum quantities of hay, silage and other feed, and to make their farms as nearly self-supporting in feed as possible by utilizing materials which formerly would have been ignored.

Rationing has been made as simple as possible but it would

have been unfair to give to each animal the same quantity of rationed feed. To meet the differences in types of soil and crops as well as differences in milk production, the scheme has been made elastic. The feed to be rationed is divided into groups i.e. protein feed and cereal feed. The first group includes oilseed cake and meal with a protein content of more than 20% as well as fish meal and certain other high protein feeds. The second class consists of cereals and low protein oil cake. Each group is rationed seperately and the proportion of each group to which a farmer is entitled varies with the type of farming and stock.

The scheme is administered largely by County War Agricultural Executive Committees. The farmer is provided with ration coupons the number of which is based on the number of stock to be fed. The farmer deposits these coupons with a merchant with whom he must register. The merchant obtains his supply by applying to the local Food Office for buying permits, the permits being exchanged for feed by Government agents.

The classes of stock for which rationed feed can be obtained include dairy cows, calves up to 6 months old, farm pigs and poultry up to ⅛ of the pre-war numbers, and working horses. There are certain other small groups for which rations are provided, the most important of which is carrier pigeons used by the Army Air Force. No rations are available for sheep, riding horses, domestic pets or for fattening cattle.

Although British farmers were asked to do their utmost to increase milk production, they were, at the same time, expected to provide from their own farms the bulk of the feed required by the dairy cows. The farmer must provide sufficient feed for the "maintenance ration" for the cows and for some part of the milk production. All milk produced must be sold to the Government and the farmer obtains additional feed in proportion to the quantity of milk certified as having been sold. Thus higher yielding cows get a larger ration of protein feed than do the cows giving a lower yield.

Keepers of pigs and poultry can only obtain rations for ⅛ of the numbers they kept on their farms before the war, but the area of the farm is also taken into account so that a large farmer receives a smaller allowance than the specialist pig or poultry producer having a small acreage. This is done to induce the large farmer to utilize to the fullest any by-products he may have on the farm such as small or damaged potatoes, etc. Considerable use is made of grazing for mature pigs and large quantities

of processed and sterilized household and hotel waste are also being utilized.

Rationed feed is supplied to calves under 6 months old in order that the milk on which they would normally be fed can be released for human consumption. Many farmers have reduced, by 50% or more, the quantities of milk they normally used for calf rearing.

Working horses also receive preferential rations and particularly the town horses and the ponies working in mines which, in many cases, have to be provided entirely with purchased feed.

Some farmers produce more oats than they require for their own livestock. In such cases they are encouraged to sell the surplus to approved buyers licensed by the Ministry of Food. Similarly supplementary protein coupons can be obtained in exchange for oats sold by farmers to approved buyers. These oats form part of the cereal ration pool and are issued to other farmers in exchange for cereal coupons.

The rationing scheme has been accompanied by intensive propaganda advising farmers on methods of conserving feed, making silage, and economic feeding. The result has been that the reduction in the cattle population has been much smaller than the cut in feed supplies would have indicated. Milk production has been maintained. Every possible pound of feed is gathered and saved. Improved methods of handling and treating feed have been introduced. Thus it has been found practicable to treat wheat and barley straw in such a way that it becomes useful feed instead of litter. In fact nothing is wasted and British farms now produce more from each acre than they have ever done before.

Which Range System?

Condensed from Turkey World

THE old standard range management rule is still good. It is stated in various ways but generally we think of it about like this: "Every 10 days to two weeks move growing turkeys to a new location on range where no turkeys, chickens, other poultry (or their droppings) have been for at least two years."

It is a good rule, but when we see how some people handle their birds, and do so successfully, it becomes evident that the rule should be applied according to individual circumstances.

For example, on top of a Pennsylvania mountain, there is a turkey grower who has raised turkeys on the same four-acre plot for many, many years. He never moves his range houses, and his livability record is above average. In central Illinois, there is a grower who has raised turkeys on the same small farm for several years. The birds range over the same ground year after year, and his death losses usually are just as light as his conscientious and fearful neighbors who move their birds according to "the book."

Going to the other extreme, we find that many turkey growers in southern and central Minnesota *actually move their birds and all equipment every three days and practically never leave them on one spot longer than five days...*

Before going into a discussion of the types of range systems, let's review briefly the scientific reasons for moving birds on range. Blackhead, of course, is the arch enemy, the main reason for putting birds on "clean" ground isolated from chickens and other poultry, and for moving frequently on range.

Everyone who has studied turkey diseases knows that ordinarily the blackhead parasite can live only a short time outside of the body of a utrkey, chicken or other fowl. If unprotected, it dies within a few hours after being passed out with droppings. The length of time the blackhead organism will live depends upon the weather and the amount of moisture and filth available. Cloudy, rainy weather, with large amounts of mud or droppings, is "blackhead paradise." Direct sun and dry weather are the opposite.

Everyone who has studied this disease knows also that the tiny cecal worm perpetuates the blackhead disease organism. It is well

Reprinted by permission from the Turkey World, Mt. Morris, Illinois, Sept., 1944

known that after the blackhead organisms are ingested by cecal worms, they somehow get into the worm eggs where they remain dormant for a long time, ready to infect healthy birds with blackhead whenever picked up with food and water.

Most of the other soil and filth-borne diseases die quickly after separation from the droppings. Coccidia, hexamita, trichomonads all are very helpless outside of the body of a turkey and die quickly, if unprotected. Sunlight and dryness are sudden death to these organisms whereas wet, cloudy weather, mud or accumulations of moist droppings prolong their lives.

This forms a satisfactory basis for prevention and control of the diseases that cause our greatest loss. First, prevent blackhead infection from reaching the birds by starting them on range that has not had turkeys, chickens or any poultry (or poultry droppings) on it for two years or more. Most of the cecal worm eggs should be dead after two years.

The second step in disease control is to keep the birds moving away from their own droppings. Even under the most ideal conditions, it seems that disease infection gets into birds on range. Wagons or sleds may carry in infection on wheels or runners. Feed sacks, feeders or other equipment may carry the infection. Old poultry crates are a common source. Birds flying from other turkey or poultry flocks are a most common source of infection. Well-meaning but careless visitors may start the trouble. As much as possible, these sources of infection should be avoided, but all turkey growers should have the knowledge that it is a practical impossibility to keep out infection. Moving away from infection and keeping the amount of infection as small as possible then is the solution to keeping down disease loss on range.

More recent investigation has added one more tool to clean ground and frequent moving. According to investigation at the Washington experiment station, phenothiazine is highly effective in the control of cecal worms. Therefore, the use of phenothiazine further tends to prevent blackhead infection carried by cecal worms.

A great many things affect the practical application of the principles just outlined, and it is here that the differences can be made in range methods. The type of soil and drainage, both surface and under drainage, and the climate are all important factors affecting range methods. Where there are light soils and good drainage, disease-producing organisms are carried away. Where

there are slopes or hills, droppings are washed down the slopes by seasonal rains. In sandy soils, disease germs and parasite eggs are carried downward with drainage water. Dry weather and direct hot sun are very effective in killing disease producing organisms and in holding their growth in check.

Now, let's consider a few typical range systems and how—and why—they are successful.

Perhaps we should start with what might be called the standard or basic system mentioned in the first paragraph. This is simply to put birds on "clean" ground (ground on which no poultry or poultry droppings have been for two or more years); and to move the birds and all equipment to a new location on clean ground every 10 days to two weeks. Feeders and fountains are moved more frequently. In this basic system, turkeys do not come back to the same ground at any time during the same season. This system is successful because the birds start on land that should be free from blackhead and other disease infection and, by moving, are kept from contact with the infection in accumulating droppings.

The above system is practically the original "Billings" system. Dr. W. A. Billings, Minnesota extension veterinarian, advised placing the brooder house or shelter on "clean" ground and moving the birds around the house or shelter in four different lots. When all of the four lots had been used, the house or shelter was moved and the plan repeated.

Usually, in the above plan, the land is in crop rotation system. The growing of cultivated crops increases the effectiveness of getting rid of any disease infection in the ground.

A variation of this system is used widely in southern Minnesota. It is used primarily where alfalfa is the range crop. Everything is moved to a new location on range every three to five days. Feeders and fountains are moved every day. One reason for this system is to avoid killing out the alfalfa stand. Everything possible is done to maintain a heavy sod. Turkeys may return to the same place two or more times during the year. Although the land may be dropped, if it is in a heavy stand of alfalfa or other good pasture mixture, the same land may be used for turkeys two or more years in succession. This system has given fair results for several reasons. First, the turkeys do not remain on one spot long enough to get it heavily contaminated. Blackhead and other disease organisms die within a few days (unless protected in cecal worm eggs), and the soil is relatively free from infection when the birds are brought back

later in the season. The heavy growth of sod tends to keep the birds from too close contact with the ground and tends to prevent formation of water puddles.

Every possible means is used to keep the growing birds free of worms, especially cecal worms. Phenothiazine, tobacco products and other materials are used extensively to prevent worms. If cecal worms are present, the range system tends to break down, as this would mean that blackhead organisms would not all die on the range lots left behind. Some would be encased in cecal worm eggs ready to reinfect birds later in the season or the following year.

Another general system about which very little is said or written is the system involving a permanent or semi-permanent roosting area. In this system, roosts are usually erected to remain in one place for the whole season. Some vary the plan by moving the roosts once or twice a year. Some use the same location year after year without moving. In most cases, the roosts are enclosed, and the birds are kept away from them during the day. They are allowed to come into the roosting area only at night and are moved out at daybreak. The birds soon learn to go to their feeders and waterers on range and to return at night. These feeders and waterers are moved to a new spot on range every few days. The roosting area may have several entrances, and as the feeders are moved around the central roosting areas, the birds enter and leave the roosting area in a different place avoiding too much contamination. In other cases, this is not possible, and the birds must go over the same ground and into the same entrance. If this is the case, every precaution should be used to prevent accumulation of droppings. Some use slatted platforms at the entrance. Others use gravel or cinders and change these occasionally.

The above system operates successfully because the birds are kept on "clean" ground by moving the feeders and waterers. Obviously, the danger is in the entrance to the roosting area, and the ground the birds must traverse in approaching the roosts.

The permanent range system is used in some parts of the country. In Missouri and Arkansas, we find permanent turkey rearing ranges placed on the tops of the ridges in the Ozark Mountains. The roosting shelters are located permanently at the top of a ridge. Usually there are two rows of shelter houses. Range yards extend down the sides of the ridge from the shelters. Each shelter has two range yards. One yard is used about five days, then the other for five days. Most

of the trees and undergrowth are cleared to give the sun a chance to help in killing disease germs.

This system is successful because the yards are on slopes and every rainfall washes the droppings down the slope. Drainage is excellent and the hot summer sun keeps the yards dry during the growing season. Another permanent range system is in use in the desert sections of the country. In many cases, no rain ever falls during the growing period. Droppings dry almost immediately. In many cases, the birds are never moved. It is obvious that the hot sun and in many cases the loose sand take care of the sanitation problem.

A somewhat similar system is used in sections having practically pure sand as the range soil but not having the desert climate. Sections of Indiana and Michigan, near Lake Michigan, are typical. Here are large areas of pure sand with practically no vegetation. Because of the heavier rainfall than in desert regions, the turkeys usually have a central roosting area and their feeders and waterers are moved occasionally.

There are many other variations, but these are typical and other systems use the same principles but vary only in their application.

The object of this article is to give the basic facts for range sanitation and present typical examples, in order that every turkey grower may plan a system that best fits his particular set of circumstances. It should be mentioned also that some of these plans represent dangerous deviations from the standard plans of range management and should not be tried without proper understanding of the possible consequences.

Any system which brings turkeys in contact with disease producing organisms or allows the accumulation of these organisms will result in trouble. However, labor and cost of production may be decreased by the practical variation of range methods to take advantage of favorable soil, drainage, topography and climatic conditions.

Ice Well Satisfactory

Condensed from The Dakota Farmer

A. L. Watt

Superintendent Mandan Dairy Station

THE ice well built, or dug, at the Mandan station in 1928 was probably the first in the Nation. This method of refrigeration has proved highly satisfactory throughout the 15 summers, 1929 to 1943, inclusive. The purpose of an ice well is to provide inexpensive refrigeration for the farm, particularly the dairy farm. By keeping cream cold, a farmer living some distance from a creamery or cream station can hold his cream longer and still market it as sweet cream, instead of sour cream. In many creameries sweet cream has brought from 3 to 5 cents, and in some cases 10 cents, more per pound of butterfat than sour cream. In addition, the ice well provides excellent refrigeration for foods such as meat, fruit, eggs, vegetables, and other dairy products.

A description of the ice well at the Station may be of interest. On a well-drained site convenient to the milk house and water supply, a hole was dug 9 feet square and 9½ feet deep. Small to medium sized rocks were placed in the bottom to a depth of 1½ feet. Two-by-four studding were placed 2 feet apart against the earth wall. Cheap unmatched lumber was nailed to the studding giving an ice-storage space approximately 8 feet square and 8 feet deep. A small structure, 10x10 feet, was built over the well. The floor was in sections to facilitate removal to allow free circulation of cold air when freezing the ice block in the winter.

On the arrival of cold weather some snow, if available, is put in the bottom of the well to cover the rock. The snow is thoroughly wet and the slush is allowed to freeze. If there is no snow a sprinkling can may be used to advantage in starting the ice on the rocks. After a solid base of ice is established in the pit, several pails of water may be added at numerous intervals during the day. In good freezing weather the block may be completed in about 60 days. If the weather is not cold enough for good progress in freezing, blocks of ice may be added after the bottom is solid, but it is preferable to have at least one foot of solid ice in the bottom before blocks are added.

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Each tier of blocks should be frozen together before the next tier is added. An average of 129 days of use per year has been attained for the period from 1929 to 1943. The well is opened and use started around May 15th and the ice lasts until well along into September. Full details of the ice well can be found in U. S. Department of Agriculture Circular 155, published in 1931.

Building a Disease-Free Herd

Condensed from The Poland China World

H. E. Biester, D. V. M.

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FOUR major steps are necessary to establish a clean herd and to keep it free from disease.

1. Acquiring healthy foundation stock.

2. Furnishing clean premises and suitable housing facilities and pasture. This also implies that these will be used properly.

3. Constant vigilance to keep out diseases.

4. Practicing sound husbandry and using good feeding methods.

In the establishment of a healthy herd it is assumed that the enterprise is directed to the maintenance of a permanent herd to which only the necessary individual animal introductions are made for genetic reasons. Traffic in feeder pigs is not permissible under this arrangement. Likewise, the practice of allowing the main herd and young pigs to follow feeder cattle cannot be tolerated. Very serious outbreaks of enteritis have been associated with pigs following cattle on dry lots.

The entire plan and its requirements for fulfillment center around the McClain County system of swine sanitation or some modification of it. As permanent lots and houses are used continuously, soil contamination by bacteria, parasitic eggs and protozoan forms, becomes increasingly severe with the result that each year the hazards of swine husbandry increase. During the first World War, most of which was fought on agricultural land that had been farmed intensively and manured over a period of centuries, relatively slight wounds frequently were followed by serious or even fatal infections as a

Reprinted by permission from The Poland China World, Webster City, Iowa, Sept., 1943

result of contamination from soil containing many pathogenic bacteria. That situation did not prevail in those theaters of war located in non-agricultural areas. A half century ago it was possible to place little emphasis on rigid sanitation and lot rotation in the corn belt, but the constant use of land by animals results in the introduction of many microorganisms through the feces. The presence of animals on restricted areas also adds organic matter that favors the growth and multiplication of pathogenic agents. The swine grower has already felt the impact of that situation. While attempting to put into effect reasonable methods of lot rotation and housing programs to meet the sanitary and nutritional requirements of some "trouble herds" the grower has often questioned the need of such plans by commenting—"My father raised hogs on this farm over 40 or 50 years ago and experienced no trouble and gave no thought to lot rotation." The answer is that much of the land had not been used intensively for swine raising in the previous century.

While the lot rotation system was devised to avoid the common round worm infestation it also prevents other infestations and infections. In addition, it accomplishes one even more important objective—improving the nutritional state of the swine.

Money invested in standard protein concentrates to supplement the home grown feeds, adequate fencing, and additional effort and vigilance on the part of the owner to move the pigs to new pastures at the proper time are the essential requirements.

Drugs and so-called disease cures or conditioners are out of place in this plan. As in any undertaking one obtains results from it in direct proportion to the effort and labor that is put into it. All this is not new to the swine breeder but like other breeders he needs to take an inventory of his methods and to determine where his technic has deteriorated and faulty practices have entered.

Lot rotation and nutrition are inseparable. Unthrifty pigs can be produced by faulty feeding, dry lots, parasitic infestations, or bacterial infections. In many cases it is difficult to incriminate only one factor because in a mismanaged herd both sanitary and nutritional factors usually are involved.

The "grass juice" factor or factors, supplied by fresh pasture or in part by some hays during the winter months, is one of the most essential materials at all times. Because of certain production goals for corn, wheat, and other crops, pasture land has been restricted and many swine growers have resorted to too much dry lot feeding of growing pigs. In-

adequate pasture may produce results almost as serious. The results of this trend are insidious, affecting not only the generation of pigs so handled, but also reflecting in the subsequent generation and beyond. We have raised experimentally on dry lots groups of pigs that received rations in which the digestible protein, carbohydrates and minerals were beyond criticism — rations that would be economically prohibitive and that could not be fed under farm conditions. Everything but the pasture was supplied. High gains in weight were made by the groups receiving high percentages of milk products. Both boars and gilts were included. In no case did the gilts conceive. At varying intervals a boar and a gilt were sacrificed for pathological study. The reason for their failure to conceive was quite apparent—microscopically the testicles of the boars showed no spermatogenesis—only one layer of altered cells remaining in the tubules and the balance of the organ showing other pathological changes. In the case of the younger gilts the ova in the ovaries were breaking down and other serious degenerative pathological changes appeared in the follicles. In the gilts destroyed after further lapses of time no ova were found and the follicles were composed of masses of hyaline material that was undergoing calcification. These animals did not show any gross changes at autopsy that would indicate the nature of the trouble. Notwithstanding their size and weight such animals could not be used for breeding purposes.

While this is an extreme illustration, carried out under controlled experimental conditions, lesser violations of the recognized principles of sound husbandry will result in premature births, weak pigs, eye deformities, depending upon the kind of deficiency to which the sow or gilt was subjected and also upon its relationship to the time of pregnancy — sometimes preceding breeding or conception.

Necrotic (Suipestifer Enteritis) and Hemorrhagic Dysentery

Necrotic or suipestifer enteritis and hemorrhagic dysentery are two specific infectious diseases. Suipestifer enteritis usually occurs when swine are kept on lots that have been used continuously over a long period. It is a disease that is comparable in its pathology to human typhoid or paratyphoid infections — purely a fifth disease. When such affected animals are placed on clean ground, recovery usually follows but the disease produces a serious set-back in growth with an economic loss. This disease can be produced experimentally by feeding cultures of the causal agent (Salmonella suipestifer),

and its production is not based upon nutritional factors, although poor sanitation and poor nutrition usually go hand in hand. A system of swine feeding that is favorable for the development of necrotic enteritis is invariably associated with faulty nutrition. When the sows and pigs are placed on pasture both sanitation and nutrition are improved. These two factors are inseparable. The lot that has harbored pigs one year should not contain pigs the next year.

Hemorrhagic dysentery is an acute highly infectious disease that bears no etiological relationship to malnutrition. We have transmitted hemorrhagic dysentery from pig to pig in over ten transfers. This was accomplished by feeding to healthy pigs a small amount of intestinal contents or diseased intestinal wall from an infected pig. We have also produced the infection by pen exposure by placing a healthy pig in a pen that previously held an infected pig—its droppings being left on the pen floor. Control pigs held in intervening pens remained healthy until given an exposure. Pigs taken from pasture and those reared experimentally on deficient rations and showing incoordination, reacted in the same manner when exposed to this infection. The specific causal agent has not been isolated. Some laboratories have referred to this infection as an "amoebic-like dysentery" because the feces contained red blood, much mucus and shreds of necrotic tissue like the stools of human cases of amoebiasis. This is erroneous and may cause confusion because no amoebae or other protozoa are involved. Hemorrhagic dysentery is a disease that is commonly brought into herds to which introductions have been made of pigs having passed through sales barns or that have been shipped over common carriers. There is no specific treatment for any of the enteric infections. They have the same standing as human enteric infections which are controlled by decreasing or eliminating the ingestion of feces. When confronted with hemorrhagic dysentery or bloody enteritis, the UNAFFECTED pigs should be moved to a clean lot and observed carefully for the appearance of additional cases, which, in turn, should be separated from the others. New breeding stock that is purchased should be quarantined on clean ground before it is placed with the main herd.

The only satisfactory method of avoiding losses from this disease is to keep it out of the herd. A grower of breeding stock or the individual farmer raising pigs for market should not allow prospective buyers or others to enter lots or buildings without first disinfecting the shoes.

Hog Cholera

Hog cholera vaccination should be a regular procedure in the corn belt where the swine population is dense. Quarantine methods appear to be very useful and effective in those states having a low swine population and where the individual herds are small and widely separated. The cheapest procedure in the long run is to depend on a qualified veterinarian who has proper facilities for keeping the biologics that have been properly handled from the time they leave the producer. The procedure is one that entails more than mere "syringe pushing." The breeder or owner also has a great responsibility here. The pigs should be free of parasites, in a good nutritional state and should not be exposed to "old lot" infections. When the common round worm passes through the intestines, liver and lungs on its journey to develop into mature worms, very serious changes appear in the chemical composition of the blood. If the pigs are vaccinated when these disturbances are in progress (with no visible clinical symptoms) post-vaccination troubles may follow.

The conditions to which a pig is subjected during the first three or four months of its life to a large measure determine the successfulness of the subsequent fattening period. A seventy or eighty pound pig reared under proper sanitary and nutritional provisions can be satisfactorily fattened on heavy grain rations. In other words the first 70 or 80 lbs of growth represents a foundation which is not substantial, results in a collapse when additional structures or weight are placed upon it. The feed received and the condition of the gilt or sow during pregnancy also play important parts in the building of this foundation.

Abortion

Abortions and birth of weak pigs that die after a short period of life may be caused not only by brucella infections but by a variety of other causes, including faulty nutrition of the sow, and probably by some factors not yet recognized. Infectious abortion or brucellosis caused by a specific bacterial infection of the sow should be suspected when abortions appear in a herd. The boar likewise may harbor the infection. The first thought to be considered by the swine breeder should be to avoid the introduction of the infection. That is the most satisfactory approach to the problem. Newly purchased breeding stock should be tested and quarantined before being placed with the existing herd. The judgment of the individual animals concerned should not merely rest upon the results of a single test on single animals, but the history of the herd from which they orig-

inate is an important factor to consider.

While the agglutination test is a reliable procedure, a single test on a single animal from an unknown source may prove misleading and disastrous. One negative reaction may be followed by a positive reaction later if the animal becomes infected at the time of testing or shortly before. The quarantined animals should also be negative to the test at the close of the quarantine period before being released to become part of the herd.

The handling of a breeding herd in which the infection is already established obviously consists of detecting the infected individuals and promptly removing them from the herd and placing the non-reacting animals on clean ground. The specific steps to be taken will depend upon the nature of the plant, size of the farm, type of buildings, nature of the herd, and the percentage of reactors. It represents an individual problem that must be considered carefully in each case and its solution must be worked out between the breeder and his veterinarian and sometimes with the laboratory conducting the tests. The success achieved by this method hinges entirely upon the prompt removal of reactors, disinfection of houses, moving non-reactors to clean lots and an early retest. If the breeder retains even one reactor in his main herd because of certain valued blood lines, the infection will be perpetuated and control measures will fail. This has been shown again and again in poultry flocks when so-called valuable breeding birds that reacted to the pullorum test were not promptly removed from the flock.

The selection of individuals for their resistance to this or other infections is still an experimental venture and is not one to be considered by the private enterpriser. The course of infectious abortion in swine and cattle is often very deceiving. The number of abortions following a severe outbreak may decrease for a time, fostering a feeling of false security that the herd in question is developing a lasting resistance to the infection or that the infection is diminishing. It is that feature of the disease that has operated to make the breeder a victim of the most ridiculous nostrums or quack remedies in the past. The decreasing number of abortions are vigorously advanced as proof of the alleged efficacy of such drugs or false conceptions of immunity. This quiescent period or infrequency of abortions is usually followed by an explosive outbreak that later may prove disastrous to the breeder.

No medicinal agent is known at the present time that is effective in the control of brucella in-

fections, and vaccines for swine have not been shown to be effective. A difference of opinion still prevails regarding the use of vaccines for cattle. Eradication of the disease from the herd and keeping it out are the only reliable and practical procedures known at the present time. Traffic of visitors and others should not be tolerated unless provision is made to enforce disinfection of the shoes of those entering the houses or lots.

Handling Poultry Manure

Condensed from Everybodys Poultry Magazine

L. M. Black

THE accumulation of poultry droppings on a commercial poultry plant has always been a problem of major importance. On some farms, particularly those with relatively small acreage, the problem often becomes serious if the farm happens to be located in a more or less residential area and the usual outlets for the product become concerned with other more important projects than the carting of the material.

Such was the dilemma that faced the Greenwork Poultry Farm at North Caldwell, New Jersey. From a modest beginning on a 15-acre tract, this plant had developed to the point where it maintained a population of 25 to 30 thousand chickens and annually grew for market 5,000 turkeys.

Many of the birds on the farm are maintained in cages and the daily cleaning of this equipment is necessary if sanitary conditions are to be observed. Four to five tons of fresh, moisture-laden droppings were gathered daily as a result of the cleaning operations on the farm. For a time, a ready sale at a fair price was found for these droppings among surrounding farmers who operated vegetable farms.

Labor shortages, however, and more important seeding and harvesting operations began to influence the regularity with which the material could be hauled away. The accumulation of the material over a period of days created a tremendous problem from the standpoint of storage facilities, obnoxious odors, the attraction of flies and undesired pests. In des-

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peration, George K. Batt, vice-president of Dugan Brothers of New Jersey, Inc., who had assumed active management of the farm, sought some more satisfactory solution to the problem.

Finally, after consultation with Dr. Firman E. Bear, Soil Chemist at the New Jersey Agricultural Experiment Station it was agreed that a study would be conducted to seek improved methods of preserving, deodorizing, and disinfecting poultry manure. The results of this study brought to light some very interesting conclusions, one, at least, which appears to be quite contrary to a supposition that has been in existence.

A careful check on feed consumption and manure voided indicated that while an average White Leghorn hen consumes 75 pounds of feed a year, the droppings which she voids amount to 144 pounds. On the basis of 1,000 birds, the annual feed intake would equal 37½ tons while the production of manure would total 72 tons. Thus, the weight of manure voided by hens is equal to twice the weight of the feed consumed. Water consumption accounts for the difference in weight that exists between intake and the excretions.

Hens kept under usual conditions deposit one-third of their droppings on dropping boards or in pits while the remainder is mixed with the litter or on the ground to which they have access. The 72 tons of manure produced by 1,000 birds contain fertilizing elements that have a potential commercial value, in normal times, of over $200. There is a strong likelihood, however, that much of the fertilizing value will be lost unless some means is used to preserve it.

The average composition of poultry manure is variable. Its ultimate analysis is influenced by the length of time during which it has accumulated, the amount of drying it has undergone, and the precautions that have been taken to avoid losses by volatilization and leaching. Water is the chief constituent of fresh manure, amounting to 80 per cent of the total volume. When the water is driven off by heating, fairly high percentages of fertilizing elements remain. This is indicated by the accompanying table which summarizes the average results of a large number of analyses.

When poultry manure is allowed to accumulate, it decomposes rapidly. Decomposition is most rapid during warm weather and as a result a large percentage of its organic matter and nitrogen is lost through volatilization. There is no loss of its phosphoric acid and potash unless it is exposed to rain when there may be a heavy loss of all its constituents. Experiments indicated a loss of nitrogen as high as 67.2 per cent

Percentage Composition of Undried and Oven-Dried Poultry Manure

		Undried Manure			Air Dried Manure		
Laying Hens	Water	N.	P_2O_5	K_2O	N.*	P_2O_5	K_2O
Fresh Manure	77.8	1.05	0.82	0.51	4.14	2.70	2.27
1 to 2 weeks old	66.8	1.41	1.03	0.57	3.02	3.11	1.73
Old Litter Manure	47.2	1.83	1.43	0.76	2.50	2.69	1.43

*Drying resulted in considerable loss of Nitrogen from these manures.

when manure was stored under cover for 60 days at summer temperatures which ranged between 70 and 80 degrees Fahrenheit.

In testing the effects of various preservatives on the retention of nitrogen, it was found that superphosphate was most effective. Larger amounts of superphosphate were more effective in preventing nitrogen loss and indications were that at least 100 pounds per ton of fresh manure should be used. Quicklime, gypsum, and peat moss were also studied from the standpoint of their effectiveness as preservatives and it was found that quicklime proved most satisfactory of the three although not as efficient as superphosphate.

When quicklime was used, it was noted that odors were greatly reduced and the physical properties of the product were markedly improved. These additional virtues compensated for the slightly greater loss of nitrogen which accompanied the use of quicklime as compared to the loss that took place when superphosphate was used.

Since quicklime is a rather difficult product to handle, it was decided to compare it with hydrated lime. This latter material resulted in improved retention of nitrogen over quicklime and maintained similar drying and deodorizing effects. The effect of both forms of lime was to slow down greatly the rate of decomposition of the manure by reason of the high alkalinity that was developed.

Further studies indicated that hydrated lime has added value as a partial disinfectant. When mixed with fresh manure at the rate of 200 pounds per ton of manure, hydrated lime was found to have a bactericidal effect on the organisms that cause pullorum, paratyphoid, fowl cholera, and fowl typhoid within a 15-minute period. Similarly, it prevented the sporulation of coccidial oocysts and the segmentation and embryonation of large round-worm eggs, so that they never reached the infective stage, even under ideal conditions for their development.

Hydrated lime makes poultry manure unattractive to flies, no

maggots having been produced in the treated manure piles. When the manure in dropping pits was treated daily with lime, rodents avoided the pile and no nests of rats or mice were found in the treated manure accumulations.

In the words of the authors of the study, the results may be summarized as follows:

"It was calculated that 81 per cent of the nitrogen, 88 per cent of the phosphoric acid, and 95 per cent of the potash fed to the hen are excreted in the manure.

"A hen consuming 75 pounds of feed per year may be expected to produce 144 pounds of manure in the same period.

"Fresh poultry manure produced by laying hens was found to contain nearly 78 per cent moisture, 1.05 per cent nitrogen, 0.82 per cent phosphoric acid, and 0.51 per cent potash.

"Untreated poultry manure lost a large percentage of its nitrogen as ammonia, especially in warm weather.

"Superphosphate was the most effective agent used in preventing the loss of nitrogen from poultry manure. Its rate of application should be at least 100 pounds per ton of fresh manure.

Chemical Capons

By implanting pellets of stilbestrol beneath the skin of the neck of young roosters, a scientist at the University of California produced all the appearances of genuine capons in his experimental birds. Masculine characteristics were lost and quite phenomenal gains in weight were obtained.

Female birds so treated assumed male characteristics. Stilbestrol is a synthetically-made female sex hormone. The drug is absorbed very slowly, and necks of birds so treated must be discarded before they are offered for sale or eaten. Midwest veterinarians, in several instances, are distributing these pellets among poultry raisers specially selected. As yet, experimentation has not gone far enough to justify widespread application to home-owned flocks. The end advantage may be in effecting quick weight gains rather than actually in making true "chemical capons."

—*Successful Farming*

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

A Living from Bees — By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. (1943). $2.00.

America's Garden Book — By Louise Bush-Brown and James Bush-Brown. Charles Scribner's Sons (1939). $3.50.

An Agricultural Testament—By Sir Albert Howard, C.I.E., M.A., former Director, Institute of Plant Industry, Indore. Oxford University Press. $3.50.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean of the School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $2.85.

Beef Cattle — By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Sons, Inc. $4.00.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers (1941). $2.00.

Breeds of Livestock in America—By Henry W. Vaughan, formerly Prof. of Animal Husbandry, Iowa State Coll., Univ. of Minn., Mont. State Univ. College Book Company. $3.75.

Dairy Cattle and Milk Production — By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. The Macmillan Co. $3.90.

Dairy Science — By W. E. Petersen, Ph.D., Assoc. Prof. and Assoc. Dairy Husbandryman, Univ. of Minn. Edited by R. W. Gregory. J. B. Lippincott Company (1939). $4.00.

Diseases and Parasites of Poultry — By Edgar Hugh Barger, D.V.M., Berkeley, Calif., and L. E. Card, Ph.D., Prof. of Poultry Husbandry, Univ. of Illinois. Lea & Febiger. 3rd Edition (1943). $3.75.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.00.

Farm Management and Marketing — By V. B. Hart, M. C. Bond, L. C. Cunningham, all of N. Y. State College of Agriculture, Cornell University. Publishers: John Wiley & Sons, Inc. (1942). $2.75.

Farm Records — By John A. Hopkins, Ph.D., Asso. Prof. of Economics, Iowa State College. Iowa State College Press. $2.50.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. (1941). $3.00.

Growing Tree and Small Fruits—By H. B. Knapp, Director, State Institute of Applied Agriculture, Farmingdale, Long Island, N. Y., and E. C. Auchter, Chief, Bureau of Plant Industry, U. S. D. A. John Wiley & Sons. $2.75.

Grow Your Own Fruit—By M. G. Kains, formerly with U. S. Dept. of Agriculture; Professor of Horticulture, Pennsylvania State College. Charles Scribner's Sons. $3.50.

How to Raise Rabbits for Food and Fur — By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept. of the Interior. Orange Judd Publishing Co., Inc. (1943). $2.00.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.

Livestock Production—By Walter H. Peters, Chief of the Division of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $3.50.

Livestock Judging Handbook — By Julius E. Nordby and W. Malcolm Beeson, Ph.D., Asst. Professors Animal Husb., Univ. Idaho. The Interstate Printers. $2.60.

Modern Agricultural Mathematics — By Maurice Nadler, B.S., A.M. Dept. of Mathematics, Newtown High School, Long Island. Orange Judd Publishing Co., Inc. (1942). $2.00.

Modern Farmers' Cyclopedia of Agriculture—By Earley Vernon Wilcox, Ph.D., Agricultural Writer, formerly with U. S. Dept. of Agriculture. Orange Judd Publishing Co., Inc. (1944). $4.50.

Natural Principles of Land Use—By Edward H. Graham,, Chief of the Biology Division of the Soil Conservation Service. Oxford University Press. 275 pages. $3.50.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry, Mo. State Univ. J. B. Lippincott Co. $5.00.

Practical Farming for the South — By Benjamin F. Bullock, now Prof. of Rural Education, Atlanta University, Atlanta, Georgia. Univ. of North Carolina Press. $2.50.

Profitable Poultry Keeping — By H. Clyde Knandel, Prof. and Head, Dept. of Poultry Husb., Penn State College. Orange Judd Publishing Co., Inc. $3.00.

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. The Macmillan Co. $3.75.

Practical Horse Breeding and Training — By Jack Widmer. Charles Scribner's Sons (1942). $3.00.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue University. The Interstate Printers & Publishers. $1.80.

Roots in the Earth—The Small Farmer Looks Ahead — By P. Alston Waring and Walter Magnes Teller. Harper & Bros. $2.50.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.00.

Soil Conservation — By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.

Some Common Diseases of Cattle—By George R. Conn, B.S.A.H., D.V.M. Orange Judd Publishing Co., Inc. (1942). $1.50.

The American Land—Its History and Its Uses — By William R. Van Dersal, biologist in the United States Department of Agriculture. Oxford University Press. $3.75.

The Farm Primer—By Walter Magnes Teller, formerly with the Farm Security Administration, U. S. D. A. David McKay Co. $2.50.

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